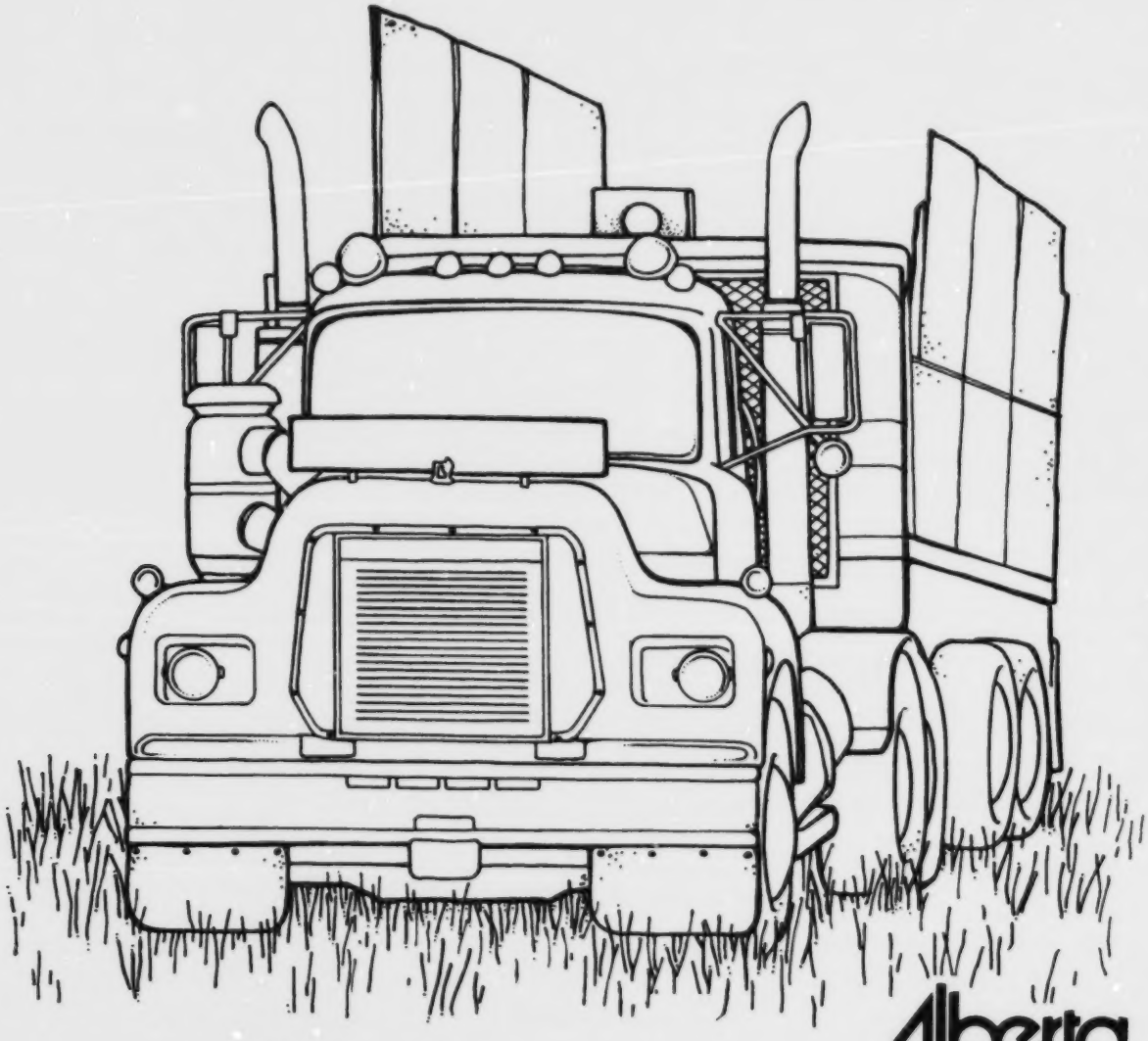
FARM TRUCKING COSTS FOR TRANSPORTING GRAIN AND GRAIN DELIVERY PATTERNS



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BY

G. NABI CHAUDHARY

PRODUCTION & RESOURCE ECONOMICS BRANCH

ALBERTA AGRICULTURE

AUGUST, 1987

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Assistance by Keith Toogood, Systems Analyst and Bob Bier, Research Assistant, in the programme development and computer analysis is very much appreciated.

FOREWORD

This report was a joint effort of the Production & Resource Economics Branch and the Alberta Wheat Pool. Its main objective was to determine the cost of transporting grain from farms to primary elevators and other market outlets using farm trucks. The report gives a good indication of the costs of moving grain by farm truck in different parts of the province. Additional information is provided on the characteristics of the study participants and their views on road conditions/ restrictions, and participant concerns about grain handling and transportation system.

Carlyle Ross
Branch Head,
Production & Resource
Economics Branch

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SECTION I

INTRODUCTION

Trucks have played an important role in the development of the grain industry on the Prairies. In the fifties and sixties, the development of better highways and road network and bigger trucks saw an increase in truck transportation. Since the early seventies, the demand for trucking services has increased significantly as a result of longer hauls and the increase in overall agricultural production.

The first Prairie producers used to haul grain by horse and wagon to primary elevators located at relatively short distances from the farm. Trucks have replaced the horse and wagon grain transportation method and have become an efficient mode of transporting grain over longer distances. Grain hauling distances continue to increase as a result of the consolidation of primary elevator systems and the rationalization of uneconomic branch lines.

Farm trucking of grain is an integral part of the entire grain handling and transportation system. The responsibility for transporting grain from the farm to shipping points (primary elevators) and other market outlets has rested with the grain producers. The number of trucks on Alberta farms has increased substantially from the seventies to early eighties because of the increased demand for trucking services. Farmers have been replacing their smaller and obsolete trucks with more fuel efficient and heavier trucks. As the distances to primary delivery points increase the grain producer has to haul grain longer distances than before.

The view has been expressed by various groups, among them producers, elevator companies and railways that changes in the grain handling and transportation system are both desirable and necessary. Costs for handling grain have been escalating at primary elevators. There is also a considerable concern over producer costs in trucking grain greater distances as a result of the closure of primary elevators and abandonment of uneconomic branch lines. The average distance from farm to primary

elevator has increased from about 11 kilometres (7 miles) to 18 kilometres (11 miles) during the last decade or so. If rationalization of grain handling and transportation system continues, farm truck hauling distances are expected to increase further.

This study was undertaken to develop an estimate of the costs incurred by Alberta farmers in transporting grain to primary elevators and other grain market outlets. A study on farm truck costs for hauling grain was completed for the 1974-75 crop year. Since then several changes have taken place in the grain handling and transportation system, making it imperative that the 1974-75 farm trucking costs be updated and that changes in the characteristics of the farm trucking fleet be documented

This study was initiated by the Production & Resource Economics Branch in the winter of 1985. In view of previous joint undertakings with the Alberta Wheat Pool in the sixties and seventies, their cooperation was solicited. After a few preliminary meetings, the following responsibilities were agreed upon for undertaking this project:

1. Questionnaire for the survey to be developed jointly.
2. Questionnaire to be reproduced by the pool and mailed to the randomly selected farmers in each pool district.
3. Completed questionnaire to be received by the Production and Resource Economics Branch.
4. Analysis and report writing to be undertaken by the Production and Resource Economics Branch.
5. Final draft of the report to be discussed with the Alberta Wheat Pool before publishing.
6. Report to be published by the Production & Resource Economics Branch.

Objectives of the Study

1. To describe the characteristics of farm trucks used in grain transportation, and the movement of grain from the farm to primary grain collection points.

2 To determine the average cost of maintaining a truck on a farm for transporting grain under various conditions, such as the age and the size of truck, the distance to the elevator, and the volume of grain transported.

3. To determine the average cost of transporting grain from a farm to a primary elevator, and to estimate the relationship between this cost and such factors as distance to the elevator, annual truck mileage, size, age of truck, volume of grain transported, and size of farm.
4. To suggest the most economical method of hauling grain to delivery points keeping in view the distance to these points, and to compare grain hauling costs between farm truck, custom and/or commercial trucks.
5. To highlight problems/concerns of grain producers under the existing grain delivery patterns.
6. To publish a report on the findings for the use of farmers, agri-business and government.

Sample Procedure

The Alberta Wheat Pool membership list was used to draw the sample. The membership list contained names of 45,000 farmers of the 55,000 farmers across the province. In order to select a representative sample of grain producers, it was decided to select a sample among those grain producers who delivered more than 100 tonnes of grain to primary elevators during the 1983-84 crop year. The main objective for selecting the study participants with the above qualifier was to have a sample which was involved in hauling a significant volume of grain to primary elevators and other market outlets.

A random selection procedure was applied with each Wheat Pool district of the province represented. The questionnaire was mailed to selected grain producers during February, 1985, and the respondents were requested to send their completed responses by the end of March. Due to financial and time constraints the personal interview approach was not followed and the grain producers were requested to mail their responses

in self-addressed stamped envelopes. The data were asked for the 1983-84 crop year as the 1984-1985 crop year was still six months away.

SECTION II

SUMMARY OF FINDINGS

This study was carried out through a questionnaire survey across the province for the 1983-84 crop year. The sample for the survey was selected from the Alberta Wheat Pool membership list. The analysis of farm truck grain transportation costs was based on 376 responses (532 grain trucks). The sample was selected in such a way that all seven districts of the Alberta Wheat Pool were represented in the study. It should be emphasized that characteristics and costs of grain transportation obtained for this study are averages for the various sample sizes for different districts in the province. Figure 1 shows the boundaries for the seven Alberta Wheat Pool districts for which data have been tabulated.

The grain transportation costs presented for different districts of the province should be considered as an indication of the farmers' own transportation costs in the respective areas. Because of the relatively small sample size in each area, the users of the information are advised to interpret the results with caution.

A summary of grain transportation costs for hauling grain to primary elevators and other market outlets is presented in Table 1. Data in Table 1 also show utilization of farm trucks in the seven districts of the province. The average grain transportation costs per farm truck were highest ($1,620.22) in the eastcentral district (No.4) and lowest ($1,250.55) in the southern district (No.1). These were $1,341.32; $1,360.62; $1,612.80; $1,521.45 and $1,435.41 for the southwestern (No.2); southeastern (No.3); westcentral (No.5); northeastern (No.6); and northwestern (No.7) districts, respectively. For the province, the average cost of transporting grain by farm truck was $1437.56. Fixed costs transporting grain in Alberta were 40.65 per cent of the total cost. For various districts it ranged from 39.49 per cent to 42.63 per cent. A considerable variation was observed among the various districts

FIGURE 1

ALBERTA WHEAT POOL DISTRICTS

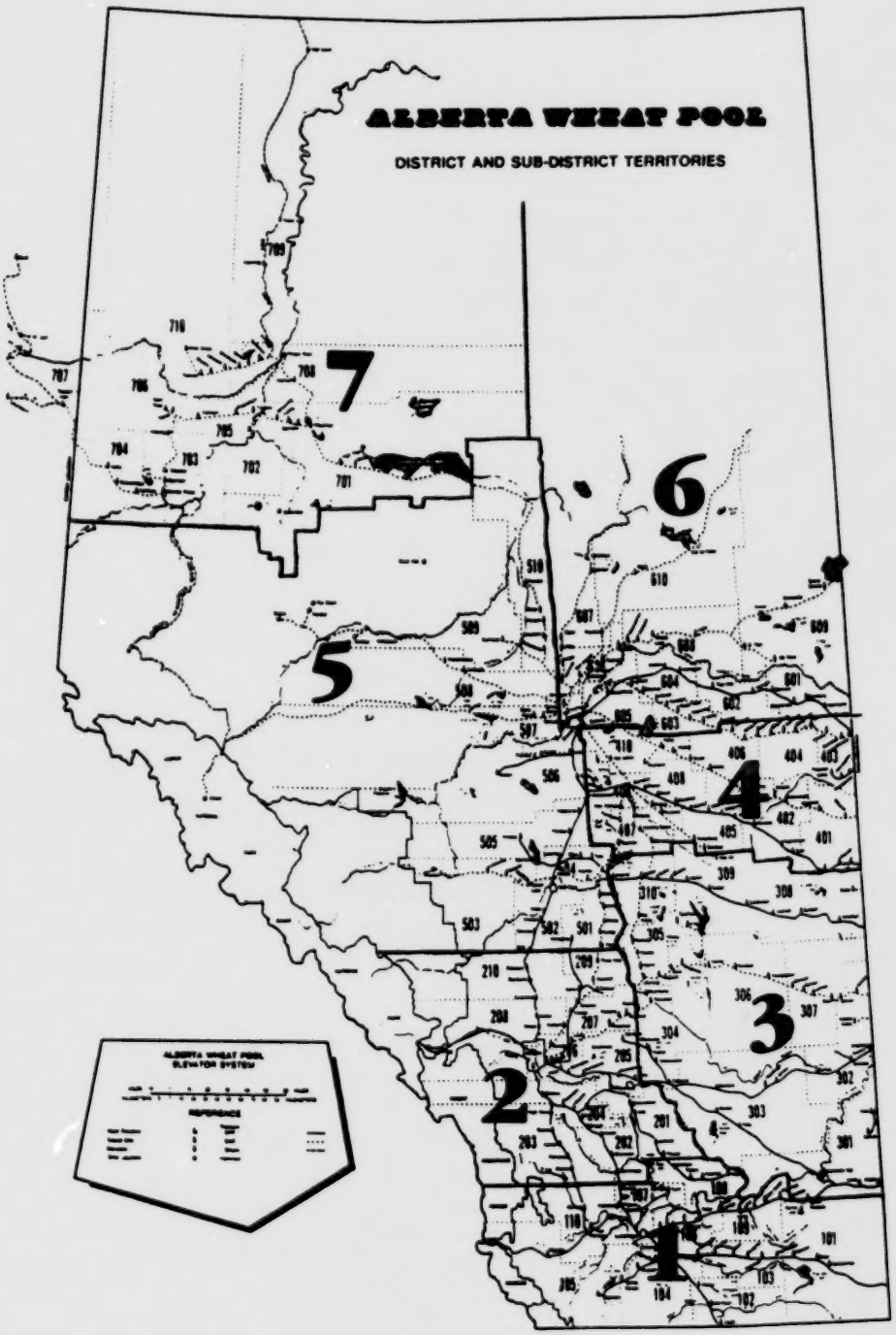

TABLE 1

AVERAGE COSTS OF TRANSPORTING GRAIN AND UTILIZATION OF FARM TRUCK BY DISTRICTS AND PROVINCE[1]

	Southern District No. 1	South-Western District No.2	South-Eastern District No.3	East-Central District No.4	West-Central District No.5	North-Eastern District No.6	North-Western District No.7	TOTAL
Number of Grain Trucks	90	74	86	59	75	81	67	532
Average Cost/Tonne (cents)	347	342	383	370	341	333	363	353
Average Cost/Tonne-Kilometre (cents)	17.39	18.60	16.59	15.45	18.24	17.69	14.16	16.83
Average Cost/Grain-Kilometre (cents)	82.54	84.95	85.85	76.16	89.62	88.59	86.21	84.91
Average Total Grain Transportation Costs ($)	1250.55	1341.32	1360.62	1620.22	1612.80	1521.45	1435.41	1437.56
Fixed Cost as Per cent of Total Grain Transportation Costs	40.60	42.63	42.04	42.37	40.31	39.49	37.20	40.65
Average Total Tonnes Transported	360.0	392.5	355.5	437.7	473.1	456.9	395.7	406.7
Average Total Tonne-Kilometres	7 193	7 213	8 201	10 486	8 843	8 603	10 135	8 542
Average Total Grain-Kilometres	1 515	1 579	1 585	2 127	1 800	1 717	1 665	1 693
Average One-Way Distance to Elevator (kilometres)	14.1	13.1	17.0	16.1	16.1	13.2	19.8	15.5
Average Annual Truck-Kilometres	5 761	4 737	5 989	6 409	5 573	5 291	5 085	5 544

1. For boundaries of districts, see map on page 6.

in truck utilization in terms of volume of grain transported, tonne-kilometers and annual truck kilometers (Table 1).

Analysis of the farm truck characteristic data showed a wide degree of variation in truck utilization across the province. The average tonnes of grain transported from farm to primary elevators and other market outlets ranged from 360 tonnes per farm in the southern district to 473 tonnes per farm in the westcentral district. The provincial average for the sample was 407 tonnes.

The average tonne-kilometres ranged from 7,193 in the southern district (No.1) to 10,135 in the northwestern district (No.7). The average tonne-kilometres for the study sample was 8,542. Average grain-kilometres was the lowest for the southern district (No.1), and highest for the eastcentral district (No.4) at 2,127 grain-kilometres.

The average one-way distance to the primary elevators during the 1983-84 crop year ranged from 13.1 to 19.8 kilometres. The average one-way distance to primary elevators for the sample as a whole was 15.5 kilometres.

The average unit costs for the province for transporting grain to primary elevators and sales outlets, were 353 cents per tonne, 16.83 cents per tonne-kilometres, and 84.91 cents per grain-kilometre.

For the southern district (No.1), the average unit costs were 347 cents per tonne, 17.39 cents per tonne-kilometre, and 82.54 cents per grain-kilometre.

The average unit costs for transporting grain in the southwestern district (No.2) were 342 cents per tonne, 18.60 cents per tonne-kilometre, and 84.95 cents per grain-kilometre.

For the southeastern district (No.3), the average unit costs were 383 cents per tonne, 16.59 cents per tonne-kilometre, and 85.85 cents per grain-kilometre.

In the eastcentral district (No.4), the average unit costs for transporting grain to primary elevators and other market outlets were 370 cents per tonne, 15.45 cents per tonne-kilometre, and 76.16 cents per grain-kilometre.

The average unit costs in the westcentral district (No.5) were 341 cents per tonne, 18.24 cents per tonne-kilometre, and 89.62 cents per grain-kilometre.

In the northeastern district (No.6), the average unit costs were 333 cents per tonne, 17.69 cents per tonne-kilometre, and 88.59 per grain-kilometre.

In the Peace River (northwestern) district (No.7), the average unit costs for transporting grain by farm truck were 363 cents per tonne, 14.16 cents per tonne-kilometre, and 86.21 cents per grain-kilometre.

Details regarding the relationships between farm truck characteristics and average costs for transporting grain for the province and the seven Alberta Wheat Pool districts are presented in the following sections.

SECTION III

ANALYTICAL PROCEDURE

The analytic package used to analyze the data was SPSS (Statistical Package for the Social Sciences). The SPSS is an integrated system of computer programs for the analysis of social science data. The system has been designed to provide the social scientists with a unified and comprehensive package enabling them to perform many different types of data analysis in a simple and convenient manner. SPSS allows a great deal of flexibility in the format of data. It provides the user with a comprehensive set of procedures for data transformation and file manipulation, and it offers the researcher a large number of statistical routines commonly used in the social sciences.[1]

SPSS was used in calculating individual costs items and unit costs in terms of costs per tonne, costs per tonne-kilometre and cost per grain-kilometre. Costs were calculated for each district and weighted by grain-kilometres as the proportion of total annual truck kilometres.

Source of the Data

The data were obtained through a questionnaire survey from grain farmers in different districts of the province. Three thousand questionnaires were mailed to randomly selected study participants from the seven Alberta Wheat Pool districts. The study participants were allowed about four to six weeks to complete and send their responses in self-addressed stamped envelopes. The number of responses was 14.3 per cent which was considerably less than expected, but those received were

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1 Norman II., Nie, Dale H. Bent and C. Hadlai Hull, Statistical Package for the Social Studies, McGraw-Hill book Company, New York, April 1971, pp.1-3.

judged to contain enough useful information to represent all the seven pool districts. Out of the 431 responses received, 376 were usable; the remainder did not contain enough information.

The following is the breakdown of responses by districts. These responses were used for analyzing farm trucking costs for transporting grain from the farm to primary elevators and other market outlets. The sample included ninety-eight grain producers who used the services of custom/commercial truckers as well.

District		No. of Responses Used
Southern,	No.1	= 59
Southwestern,	No.2	= 54
Southeastern,	No.3	= 59
Eastcentral,	No.4	= 47
Westcentral,	No.5	= 50
Northeastern,	No.6	= 62
Northwestern,	No.7	= 45
TOTAL		= 376

The above respondents (376) reported 1,189 farm trucks, i.e., 3.2 trucks per farm in the province. Out of these trucks, five hundred and thirty-two trucks were used for transporting grain from farm to primary elevators and other sales outlets. Distribution of grain trucks and total number of trucks reported by districts was as follows:

District		Trucks Reported	Grain Trucks
Southern,	No.1	209	90
Southwestern,	No.2	179	74
Southeastern,	No.3	207	86
Eastcentral,	No.4	141	59
Westcentral,	No.5	152	75
Northeastern,	No.6	160	81
Northwestern,	No.7	141	67
TOTAL		1189	532

A total of five hundred and thirty-two trucks were used in determining the cost of transporting grain in Alberta from farm to primary elevators and other sales outlets.

Assumptions

The trucks reported by the study participants were not exclusively used for transporting grain from farm to delivery points, but have some other uses as well, like hauling livestock, travelling (personal use), and for moving other farm commodities. It would not be correct to attribute all of the fixed and variable trucking costs to grain transportation. Hence, grain transportation costs were calculated by weighting (except driving labor and dead-haul labor) by grain-kilometres as a proportion of total annual truck kilometres. Driving labor and dead-haul labor costs were not weighted because these only involved grain transportation.

An important assumption for calculating grain transportation costs in this study was that each trip to the elevator or other sales outlet was charged entirely to the transportation of grain. It was assumed that the farmer did no other business while in the process of hauling grain. Round trip distance was included for cost calculation purposes and in calculating grain-kilometres, rather than using only the loaded distance.

Fixed Costs:

Depreciation

Depreciation is defined as the loss in value over time due mainly through obsolescence. In the case of trucks, it is that portion of the decrease in truck value not attributable to truck use. Obviously, part of the reduced value is a result of usage and is not entirely due to ownership and the passage of time. However, it is virtually impossible to determine that portion which should be termed as variable cost; therefore, the entire depreciation has been considered as a fixed cost.

Capital assets such as trucks are purchased at one period in time with the expectations that they will be utilized over a number of time periods. Since the value of these vehicles must decrease with age, usage and obsolescence, it is expected that at some time in the future the vehicle must be replaced. Since its value or usefulness is consumed over a number of time periods, the cost of the depreciation of the asset must be distributed over these periods. As the age of the truck increases, its reliability may or may not be impaired, depending on the manner in which it is maintained and the tasks which it is expected to perform.[2] To work out the true depreciation for a given truck, therefore, becomes a very complicated task.

There are several possible ways to compute the rate of depreciation. The choice of method depends mostly on the rate at which the asset seems to lose its value. It also depends partly on the relative ease of computation by different methods which accomplish essentially the same result. According to Hopkins and Heady[3] five methods are used in farm accounting. These are the annual revaluation method, straight-line method, diminishing balance method, sum-of-year digits method and the compound interest method. Some of these methods, in particular the last one, are not appropriate for grain trucks. The first three methods could be applied to a grain truck.

The annual revaluating method determines the depreciation through establishing a market value of the asset. Application of this method for determining the depreciation for a grain truck is unsatisfactory. Amounts arrived at in this manner during the first couple of years of use of a truck diminish sharply because there is a rapid loss in resale value. This method is sensitive to economic fluctuations and results in difficulty in deciding what market price to use for determining the depreciation.

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2 E.W. Tyrchniewicz, A.H. Butler and O.P. Tangri, The Cost of Transporting Grain by Farm Truck, Research Report No.8, Centre for Transportation Studies, The University of Manitoba, Winnipeg, Manitoba, July 1971, p. 21.

3 J.A. Hopkins and E.O. Heady, Farm Records and Accounting, Ames: The Iowa State University Press, 1962, pp.76-80.

The straight-line method consists of dividing total anticipated depreciation by number of years the machine is expected to last and to find the depreciation for each year. This method works fairly well for analyzing the farm business if the machine or other items will be used in a rather constant amount through the years. In the case of truck usage, it is considered less satisfactory because of variation in truck use over the years.

The diminishing balance method appears to conform more closely to decline in resale value. By this method a percentage of the remaining value is deducted each year for depreciation. This method has the disadvantage of charging a higher rate of depreciation against the first year when the machine is expected to last for a certain number of years.

All three methods have merits and demerits. For the purposes of this study the diminishing balance method was used because no information was furnished on the current market price of the truck used for hauling grain. The average life of a truck was assumed to be 15 years and some older trucks still in use were allocated 10 per cent of the original price to calculate depreciation.

Interest on Investment

Interest is defined as a sum paid or calculated for the use of capital. The sum is usually expressed in terms of a rate or percentage of the capital involved, called the interest rate.

Interest is charged for the use of capital investment. Had the capital not been invested for buying a specific asset, it could have been utilized elsewhere, either within or outside the firm, and would have brought some additional return to the firm.

A flat rate of 15 per cent was used for the purposes of this study to determine a fair return to truck investment. This was calculated on the purchase price of trucks, as reported in the questionnaires.

Licence Fees

Licence fees are annual fees paid by the owner of the vehicle for registration purposes. Such fees are based on the gross vehicle weight of the truck and the type of service performed. License fees were used as reported in the questionnaires.

Insurance

Insurance premiums for farm trucks are costs which have no relationship to the usage of the unit. They are based on a specific coverage and are thus a fixed cost. The insurance costs were used as obtained from the questionnaires.

Variable Costs:

Lubrication

The lubrication costs included oil, filters, grease and antifreeze. These costs were taken from the questionnaires as reported. The respondents gave a reasonable estimate of lubrication costs for the trucks they owned.

Repairs

The total cost of parts for making repairs was directly taken from the questionnaires. The farmers were able to give a reasonably reliable estimate of repair costs.

Tires and Batteries

Tire and battery costs per farm truck were not spread out over a number of years. In some cases no costs were incurred. However, the costs reported in the questionnaires were used in this study.

Maintenance and Repair Labour

An hourly labor charge for all trucks was calculated using the hourly value of operator, family labor, and hired labor. Farmers were asked to estimate the number of hours spent by individuals on maintenance and repair of trucks used for hauling grain. The hourly labor rates used in this study were $6.50 for operator and hired labor, and $4.50 for family members.

Fuel

Annual fuel costs for each truck were determined by dividing the annual truck mileage by average kilometres per litre, and then multiplying the number of litres by the price per litre. Fuel costs for hauling grain were allocated on the basis of proportion of grain-kilometres to annual truck kilometres.

Driving Labor

Farmers were asked to estimate the average time it took to make a trip from the farm to the elevator and other sales outlets and back to the farm. The total driving time for transporting grain was calculated by multiplying the number of trips during the year by the travel time for each trip. Driving labor costs were calculated by multiplying total driving time (hours) spent by operator, hired worker, and family with respective hourly labor charge of $6.50 for operator and hired and $4.50 for family member.

Dead-Haul Labor

Dead-haul labor time was calculated by adding the time taken for loading-unloading grain and waiting time, if any, while delivering grain to primary elevators and other sales outlets. The total dead-haul labor time was arrived at by multiplying the number of trips

hauling grain during the year by dead-haul time for each trip. Dead-haul labor costs were obtained by multiplying the dead-haul labor time for operator, hired worker and family member by the respective hourly wage rates mentioned above.

The various costs listed above were the common costs among various uses of grain trucks. These costs (except driving and dead-haul labor costs) were allocated to grain traffic by using the criterion of "proportion of grain haul kilometres to annual truck kilometres".

Computation of Total and Individual Cost Components

This subsection describes the methodology followed to compute various items of trucking cost. The cost for transporting grain was divided into two major categories fixed and variable costs.

Total cost is the summation of fixed and variable costs as shown below:

1) $TC = FC + VC$

TC = Total cost
FC = Fixed cost
VC = Variable cost

2) $FC = D + I + L + IC$

D = Depreciation
I = Interest on investment
L = License fees, and
IC = Insurance cost

3) $VC = LC + R + T + M + F + DL + DHL$

LC = Lubrication cost
R = Repairs - parts, etc
T = Tires and batteries
M = Maintenance and repair labor
F = Fuel - gasoline/diesel
DL = Driving labor
DHL = Dead-haul labor

Computation of Unit Costs of Grain Transportation

After calculating the total grain transportation costs for each truck, unit costs of grain transportation were determined considering the units being the tonne, the tonne-kilometre, and the grain-kilometre.

The unit costs were calculated as follows:

1. Total Grain Transportation Costs = weighted total fixed costs + weighted total variable costs (excluding driving and dead-haul labor costs) + driving labor costs + dead-haul labor costs.
2. Average Cost Per Tonne = total grain transportation costs divided by total tonnes of grain transported.
3. Average Fixed Cost Per Tonne = weighted total fixed costs divided by total tonnes of grain transported.
4. Average Variable Cost Per Tonne = average cost per tonne minus average fixed cost per tonne.
5. Average Cost Per Tonne-Kilometre[1] = total grain transportation costs divided by total tonne-kilometres.
6. Average Fixed Cost Per Tonne-Kilometre = weighted total fixed costs divided by total tonne-kilometres.
7. Average Variable Cost Per Tonne-Kilometre = average cost per tonne-kilometre minus average fixed cost per tonne-kilometre.
8. Average Cost Per Grain-Kilometre[2] = total grain transportation costs divided by annual truck-kilometres in grain transportation.
9. Average Fixed Cost Per Grain-Kilometre = weighted total fixed costs divided by annual truck-kilometres in grain transportation.
10. Average Variable Cost Per Grain-Kilometre = average cost per grain-kilometre minus average fixed cost per grain-kilometre.

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(1) Tonne-Kilometre is equal to a tonne of grain transported to various market outlets including primary elevators multiplied by the one-way distance to primary elevators and other market outlets.

(2) Grain-kilometre represents a load of grain transported over one kilometre of distance (one-way).

Hypotheses

Several hypotheses were formulated to study the relationship between grain transportation costs and factors such as size of truck, age of truck, one-way distance to elevator, size of farm, and utilization of the truck. The hypothesized relationships examined in this study were as follows:

1. The average cost per tonne-kilometre decreases as size of truck increases.
2. The average cost per tonne-kilometre decreases as with the decrease in the age of truck.
3. The average cost per tonne-kilometre decreases as one-way distance to the elevator increases.
4. The average cost per tonne-kilometre decreases as size of farm (a less direct measure of truck utilization) increases.
5. The average cost per tonne-kilometre decreases as utilization of truck measured by total tonnes transported, annual truck kilometres, and total tonne-kilometres increases.

SECTION IV

GRAIN TRANSPORTATION COSTS BY FARM TRUCK IN ALBERTA

Grain transportation costs by farm truck were weighted by grain-kilometres as a proportion of total annual truck kilometres, except for driving labor and dead-haul labor. Therefore, the costs presented in this study are not the total for a truck, rather, these are the portions of all costs attributable to transportation of grain from farms to primary elevators and other market outlets.[4]

Total Cost of Grain Transportation

The total grain transportation cost per farm truck in Alberta was calculated to be $1,437.56 during the 1983-84 crop year. Total fixed costs per truck amounted to $584.39 or 40.65 per cent of the total grain transportation costs.

The largest component of grain transportation costs was interest on investment, which accounted for 19.21 per cent ($276.09) of the total costs. This was followed by depreciation at $239.82 (16.68 per cent), fuel at $218.01 (15.15 per cent), dead-haul labor at $196.43 (13.67 per cent), and driving labor at $194.10 (13.51 per cent). Detailed break-down of various costs components is presented in Table 2.

The estimate of total grain transportation costs is based on 532 farm trucks across the province used for transporting grain from farm to primary outlets. On the whole, the 532 trucks reported in the survey, carried 216,840 tonnes (9,107,414 bushels) of grain to primary elevators and other sales outlets. In terms of tonne-kilometres, farm trucks reported in the survey provided 8,542 tonne-kilometres (118,621,782 bushel-miles) of service in transporting grain from the farm to primary elevators and other market outlets.

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4 Other market outlets include seed plants, feed mills, crushing plants, feedlots, and delivery to other farms.

AVERAGE TOTAL COST OF TRANSPORTING GRAIN PER FARM TRUCK IN ALBERTA

Variable Costs

	Lubric.	Parts	Tires and Batteries	Maintenance and Repair Labor	Fuel	Driving Labor	Dead-Haul Labor	Total Variable Costs
Dollars	23.02	109.90	71.47	40.25	218.01	194.10	196.43	853.17
Per cent	1.60	7.65	4.97	2.80	15.15	13.51	13.67	59.35

Fixed Costs

	Depreciation	Interest on Investment	License	Insurance	Fixed Costs	Total Grain Transportation Costs
Dollars	239.82	276.09	14.02	54.46	584.39	1437.56
Per cent	16.68	19.21	0.97	3.79	40.65	100.00

Unit Costs of Transporting Grain by Farm Truck

The unit costs are the most common costs quoted for transporting grain by farm truck. Three types of average unit costs were calculated, the units being the tonne, tonne-kilometre, and the grain-kilometre. These unit costs divided into fixed and variable costs are presented in Table 3.

Average cost per tonne for transporting grain from farm to primary elevators and other market outlets was 353 cents, with the average variable cost being 209.51 cents and the fixed cost at 143.49 cents.

The average grain transportation cost per tonne-kilometre was calculated to be 16.83 cents. Average variable cost per tonne-kilometre was 9.99 cents and average fixed cost per tonne-kilometre was 6.84 cents.

The average cost per grain-kilometre of transporting an average load of grain during the 1983-84 crop year was 84.91. The average variable cost per grain-kilometre was 50.39 cents and the average fixed cost per grain-kilometre was 34.52 cents.

The average grain transportation costs per bushel, bushel-mile, and grain-mile are presented in parenthesis in Table 3.

Cost of Transporting Grain and its Relationship With Size and Age of Truck

Size of Truck:

The size of farm truck used for transporting grain from farm to primary elevators and other market outlets was measured in (i) gross vehicle weight (GVW in kgs) and (ii) capacity of grain box in tonnes.

The relationship between size of truck measured by gross vehicle weight (GVW) in kilograms and average cost tonne, and per tonne-kilometre was definitely an inverse relationship, i.e., as size of farm truck increased, average unit costs decreased (Table 4). The highest average cost per tonne was for trucks in the size group 10,000 kg or less (397 cents), and the lowest for the size group of over 14 000 kg, (346 cents).

TABLE 3

UNIT COSTS OF TRANSPORTING GRAIN BY FARM TRUCK IN ALBERTA

Units	Average Variable Cost	Average Fixed Cost	Average Cost
	Cents	Cents	Cents
Tonne*	209.51	143.49	353.00
(Bushel)	(4.99)	(3.41)	(8.40)
Tonne - Kilometre**	9.99	6.84	16.83
(Bushel - Mile)	(0.39)	(0.26)	(0.65)
Grain-Kilometre	50.39	34.52	84.91
(Grain - Mile)	(81.08)	(55.54)	(136.62)

* 1 tonne = 42 bushels
** 1 kilometre = 0.6216 miles

TABLE 4

RELATIONSHIP BETWEEN SIZE OF TRUCK (MEASURED BY GROSS VEHICLE WEIGHT) AND GRAIN TRANSPORTATION COSTS, ALBERTA

	Gross Vehicle Weight in Kilograms				
	0-10 000	10 001-12 000	12 001-14 000	Over 14 000	All Trucks
Average Size of Truck (Kg)	8 200	10 900	12 900	20 400	14 300
Number in Sample	77	75	212	168	532
Average Cost/Tonne (cents)	397	358	351	346	353
Average Cost/Tonne-Kilometre (cents)	23.45	19.21	20.82	13.58	16.83
Average Cost/Grain-Kilometre (cents)	81.29	71.62	86.40	87.79	84.91
Average Total Grain Transportatin Costs ($)	801.98	963.47	1364.09	2033.24	1437.56
Fixed Cost as Per cent of Total Grain Transportation Cost	33.30	36.45	42.33	41.44	40.65
Average Total Tonnes Transported	202.1	268.8	388.4	588.1	407.6
Average Total Tonne-Kilometres	3 420	5 017	6 553	14 972	8 542
Average Total Grain-Kilometres	987	1 345	1 579	2 316	1 693

Similarly, the average unit cost per tonne-kilometre was the highest for lighter trucks (0-10 000 kg) and lowest for heavier trucks (over 14 000 kg).

The average fixed cost as per cent of total grain transportation costs showed a positive relationship with the size of truck measured by gross vehicle weight (GVW) in kilograms. In other words, fixed costs as per cent of the total grain transportation cost increased as the size of farm truck increased.

Utilization of farm trucks in terms of tonnes of grain transported, tonne-kilometres of service provided, and grain-kilometres showed a positive relationship with size of truck. With the increase in size of farm trucks utilization level also increased.

Details regarding average size of truck by GVW classification, unit costs, total grain transportation costs, and utilization of farm trucks are provided in Table 4.

When size of truck was measured by the capacity of grain box in tonnes, the average unit costs per tonne and tonne-kilometre showed an inverse relationship, that is, as the size of grain box increased, the unit costs decreased. Average cost per tonne ranged from 488 cents for the smallest group to 334 cents for the largest group. For the intermediate group of farm trucks, the average unit cost per tonne was 347 cents.

Average unit cost per tonne-kilometre was also the highest for trucks with less than 7 tonne box capacity at 30.17 cents. It was 19.60 cents per tonne-kilometre for trucks with box capacity of 7.1 to 9.5 tonnes, and 13.07 cents per tonne-kilometre for trucks with box capacity over 9.5 tonnes.

The relationship between average unit cost per tonne and the size of grain box capacity supported the hypothesis that as the size of truck in terms of grain box capacity increased, average cost per tonne decreased.

A positive relationship was observed between the size of truck (grain box capacity) and utilization levels measured in tonnes transported and tonne-kilometres service. Fixed cost as per cent of

total grain transportation costs also showed a positive relationship; that is, as size of truck increased, proportion of fixed cost also increased. Detailed breakdown of unit costs, total costs, and utilization of farm trucks by different classes of capacity of grain box are presented in Table 5.

Age of Truck:

The relationship between age of truck and average costs per tonne, per tonne-kilometre and per grain-kilometre was positive (Table 6). A positive relationship showed that newer trucks had higher unit costs. The average cost per tonne was 308 cents for trucks in the 1964 and older category which increased to 427 cents for trucks in the 1980-84 class. Similarly, other unit costs showed upward trends. As expected, the proportion of fixed cost of total grain transportation costs was much higher for trucks in 1980-84 category as compared to older trucks.

The average total grain transportation costs showed a smooth relationship with age of truck. The level of farm truck utilization as measured by total tonnes transported, total tonne-kilometres and grain-kilometres, all showed positive a relationship with the age of truck. The average annual truck kilometres another measure of truck utilization also showed an upward trend.

The figures in Table 6 clearly indicate that newer trucks had a higher utilization level for transporting grain to primary elevators and other market outlets than trucks overall.

Relationship Between One-Way Distance to Elevator and Grain Transportation Costs

The relationship between the one-way distance to the elevator and average cost per tonne-kilometre was negative, that is, the average cost per tonne-kilometre decreased as the one-way distance to the primary elevator increased (Table 7). The average cost per tonne-kilometre ranged from a high of 19.75 cents for trucks in 0 to 11 kilometres group to a low of 14.30 cents for trucks in over 23 kilometres group. The average cost per tonne showed no clear-cut relationship as unit costs fluctuated

TABLE 5

RELATIONSHIP BETWEEN SIZE OF TRUCK (MEASURED BY CAPACITY OF BOX IN TONNES)

AND GRAIN TRANSPORTATION COSTS, ALBERTA

	Capacity of Grain Box in Tonnes			
	0-7.0	7.1-9.5	Over 9.5	All Trucks
Average Capacity of Grain Box (t)	5.4	8.2	13.3	9.1
Number in Sample	116	258	158	532
Average Cost/Tonne (cents)	488	347	334	353
Average Cost/Tonne-Kilometre (cents)	30.17	19.60	13.07	16.83
Average Cost/Grain-Kilometre (cents)	83.36	80.60	91.08	84.91
Average Total Grain Transportation Costs ($)	747.80	1415.85	1979.42	1437.56
Fixed Cost as a Per cent of Total Grain Transportation Costs	39.46	39.37	42.48	40.65
Average Total Tonnes Transported	153.6	408.9	593.3	407.6
Average Total Tonne-Kilometres	2 478	7 224	15 145	8 542
Average Total Grain-Kilometres	897	1 757	2 173	1 693

TABLE 6

RELATIONSHIP BETWEEN AGE OF TRUCK AND GRAIN TRANSPORTATION COSTS, ALBERTA

	Year of Truck					
	1964 And Older	1965-1969	1970-1974	1975-1979	1980-1984	All Trucks
Average Year of Truck	1960	1967	1973	1977	1981	1973
Number in Sample	63	83	121	181	84	532
Average Cost/Tonne (cents)	308	309	324	342	427	353
Average Cost/Tonne-Kilometre (cents)	15.90	15.51	15.85	16.87	18.32	16.83
Average Cost/Grain-Kilometre (cents)	66.77	72.32	80.63	85.98	97.50	84.91
Average Total Grain Transportation Costs ($)	597.05	906.80	1342.79	1476.55	2644.89	1437.56
Fixed Cost as Per cent of Total Grain Transporation Costs	24.03	27.15	32.61	40.40	54.21	40.65
Average Total Tonnes Transported	193.9	293.0	414.5	431.9	618.9	407.6
Average Total Tonne-Kilometres	3 756.03	5 845.51	8 473.04	8 755.06	14 434	8 541.67
Average Total Tonne Grain-Kilometres	894	1 254	1 665	1 717	2 713	1 693
Average Annual Truck Kilometres	2 951	4 272	5 346	6 195	7 628	5 544

TABLE 7

RELATIONSHIP BETWEEN ONE-WAY DISTANCE TO CLOSEST ELEVATOR AND GRAIN TRANSPORTATION COSTS, ALBERTA

	One-Way Distance To Elevator in Kilometres					
	0-11.0	11.1-15.0	15.1-19.0	19.1-23.0	Over 23.0	All Trucks
Average One-Way Distance to Elevator (kilometres)	6.9	12.5	16.5	20.2	32.8	15.5
Number in Sample	192	123	55	66	96	532
Average Cost/Tonne (cents)	263	314	405	397	516	353
Average Cost/Tonne-Kilometre (cents)	19.75	18.73	15.60	16.43	14.30	16.83
Average Cost/Grain-Kilometre (cents)	96.53	89.55	84.23	82.71	74.33	84.91
Average Total Grain Transportation Costs ($)	1035.70	1294.74	1725.84	1701.83	2077.44	1437.56
Fixed Cost as Per cent of Total Grain Transporation Costs	40.94	40.15	44.22	36.01	41.68	1437.56
Average Total Tonnes Transported	394.5	412.6	425.8	428.3	402.8	407.6
Average Total Tonne-Kilometres	5 245	6 913	11 065	10 350	14 526	8 542
Average Total Grain-Kilometres	1 073	1 445	2 049	2 057	2 795	1 693
Average Annual Truck Kilometres	4 309	5 310	6 154	5 587	7 935	5 544

considerably. However, as hypothesized, average cost per grain-kilometre showed a negative relationship with one-way distance to primary elevator.

No discernable relationship was found between one-way distance to the primary elevator and the average total grain transportation costs. Truck utilization in terms of tonne-kilometres service and grain-kilometres showed upward trends reflecting increased use of farm trucks with the increase in distance to market outlets. The average annual truck kilometres also showed a positive relationship with one-way distance to primary elevators.

Relationship Between One-Way Distance to all Delivery Points and Grain Transportation Costs

As hypothesized, the relationship between one-way distance to all delivery points (primary elevators and other market outlets) and average cost per tonne-kilometre was negative. In other words, unit-cost per tonne-kilometre decreased as distance to delivery points increased. Average distance to all delivery points ranged from 7.6 to 36.5 kilometres. Provincial average grain transportation distance to all delivery points for the study sample was 20.1 kilometres (12.5 miles). Details on average cost per tonne, average cost per tonne-kilometre, average cost per grain-kilometre, average total grain transportation costs, and utilization of farm trucks in terms of tonnes of grain transported, tonne-kilometres, and average total grain-kilometres, etc. are presented in Table 8.

Relationship Between Size of Farm, Annual Truck Kilometres, Tonnes Transported, Tonne-Kilometres and Grain Transportation Costs

Size of Farm:

A less direct measure of truck utilization might be the size of farm in acres. In general one would expect that trucks would be utilized more on larger farms than on smaller farms. Hence, the average unit costs would be lower on larger farms as compared to smaller farms.

TABLE 8

RELATIONSHIP BETWEEN ONE-WAY DISTANCE TO ALL DELIVERY POINTS AND GRAIN TRANSPORTATION COSTS, ALBERTA

	One-Way Distance to all Delivery Points in Kilometres					
	0.0-11.0	11.1-15.0	15.1-19.0	19.1-23.0	Over 23.0	All Trucks
Average One-Way Distance to Delivery Points (kilometres)	7.6	12.9	16.8	20.7	36.5	20.1
Number in Sample	127	115	70	62	158	532
Average Cost/Tonne (cents)	221	296	348	381	467	353
Average Cost/Tonne-Kilometre (cents)	28.33	22.51	20.74	18.58	12.96	16.83
Average Cost/Grain-Kilometre (cents)	122.58	104.00	92.01	82.12	72.07	84.91
Average Total Grain Transportation Costs ($)	862.77	1108.69	1377.12	1387.60	2185.33	1437.56
Average Total Tonnes Transported	391.1	374.3	395.3	364.2	467.6	407.6
Average Total Tonne-Kilometres	3 046	4 923	6 641	7 466	16 857	8 542
Average Total Grain-Kilometres	704	1 066	1 497	1 690	3 032	1 693
Average Annual Truck Kilometres	3 415	4 571	4 554	5 425	8 449	5 544

This expectation was supported to some extent but not for all the categories of size of farms, as there was a considerable variation in the level of truck utilization (Table 9).

The average cost per tonne ranged from 331 cents for trucks in the 901-1,280 acre farm size group to 384 cents for farms less than 640 acres in size. The average cost per tonne-kilometre was the lowest at 14.42 cents for farms in over 1,600 acres farm size, and the highest at 22.02 cents per tonne-kilometre for farms in 641-900 acres group. A similar trend was observed between the average cost per grain-kilometre and the different groups of size of farms.

Truck utilization in terms of total tonnes of grain transported and total tonne-kilometres showed positive relationships with the size of farm. The only exception was for trucks in 1,281-1,600 acres farm size group. For this group, the utilization level of farm trucks showed a slight decline in an otherwise upward utilization trend. The average annual truck kilometres showed a clear-cut upward trend with the increase in the size of farms.

Annual Truck Kilometres:

When utilization of grain trucks was measured by annual truck kilometres, a negative relationship was found between annual truck kilometres and average cost per tonne-kilometre as exhibited by the results in Table 10.

Average cost per tonne-kilometre ranged from 42.93 cents for trucks travelling up to 1,609 kilometres annually to 10.45 cents for the most utilized trucks averaging over 9,654 kilometres annually. A similar relationship was exhibited between average cost per grain-kilometre and the annual truck kilometres i.e., annual use of trucks.

Farm truck utilization in terms of total tonnes transported and total tonne-kilometres showed a positive relationship with annual truck kilometres, i.e., utilization of farm trucks increased with the increase in truck kilometres. Fixed costs as per cent of total grain transportation costs also showed a smooth relationship with annual truck kilometres. No discernable relationship was depicted between total grain-kilometres and annual truck kilometres.

TABLE 9

RELATIONSHIP BETWEEN SIZE OF FARM IN ACRES AND TOTAL GRAIN TRANSPORTATION COSTS, ALBERTA

	Size of Farm in Acres					
	0-640	641-900	901-1280	1281-1600	Over 1600	All Trucks
Average Size of Farm in Acres	461	825	1 141	1 505	3 577	1 777
Number in Sample (grain trucks)	107	113	66	66	180	532
Average Cost/Tonne (cents)	384	346	331	336	357	353
Average Cost/Tonne-Kilometre (cents)	20.06	22.02	17.05	17.53	14.42	16.83
Average Cost/Grain-Kilometre (cents)	86.47	96.78	84.31	88.13	79.68	84.91
Average Total Grain Transportation Costs ($)	1026.47	1231.42	1403.67	1400.81	1837.25	1437.56
Fixed Cost as Per cent of Total Grain Transportation Costs	41.23	41.58	40.84	37.62	40.85	40.65
Average One-Way Distance to Elevator (kilometres)	14.7	13.7	15.8	14.7	17.2	15.5
Average Total Tonnes Transported	267.1	355.8	423.8	417.2	514.2	407.6
Average Total Tonne-Kilometres	5 116	5 592	8 231	7 992	12 744	8 542
Grain-Kilometres as Per cent of Annual Truck Kilometres	27.73	27.95	34.18	29.60	31.90	30.53
Average Annual Truck Kilometres	4 280	4 552	4 871	5 370	7 228	5 544

TABLE 10

RELATIONSHIP BETWEEN ANNUAL TRUCK KILOMETRES AND GRAIN TRANSPORTATION COSTS, ALBERTA

	Annual Truck Kilometres						
	0-1609	1610-3218	3219-4827	4828-7240	7241-9654	Over 9654	All Trucks
Average Annual Truck Kilometres	1 228	2 902	4 498	6 159	8 341	15 700	5 544
Number in Sample	100	109	109	71	90	53	532
Average Cost/Tonne (cents)	454	394	327	352	323	353	353
Average Cost/Tonne-Kilometre (cents)	42.93	27.43	20.33	18.15	14.15	10.45	16.83
Average Cost/Grain-Kilometre (cents)	186.11	110.49	94.19	78.04	70.77	68.55	84.91
Average Total Grain Transportation Costs ($)	634.79	1067.88	1449.02	1780.59	1681.14	2815.80	1637.56
Fixed Cost as Per cent of Total Grain Transportation Costs	48.32	46.76	43.31	39.92	34.85	36.31	40.65
Average Total Tonnes Transported	140.0	271.3	433.6	505.3	520.1	797.1	407.6
Average Total Tonne-Kilometres	1 479	3 893	7 129	9 812	11 884	26 957	8 542
Grain-Kilometres as Per cent of Annual Truck Kilometres	27.76	33.30	34.21	37.05	28.48	26.16	30.53

Tonnes Transported:

The relationship between average tonnes of grain transported, average cost per tonne, average cost per tonne-kilometre, and average cost per grain-kilometre was negative as hypothesized as indicated by the results in Table 11. A negative relationship between unit costs and tonnes of grain transported showed that unit costs decreased with the increase in the volume of grain transported.

Other measures of farm truck utilization (tonne-kilometres, grain-kilometres, and average annual truck kilometres) exhibited a positive relationship with the average total tonnes transported. Details on unit costs and total grain transportation costs are provided in Table 11.

Tonne-Kilometres:

When the study sample was classified by tonne-kilometres service as a measure of farm truck utilization, about two-thirds of farm trucks provided over 3,065 tonne-kilometres service during the 1983-84 crop year. The relationship between total tonne-kilometres and average cost per tonne-kilometres was definitely negative (Table 12). The relationship between total tonne-kilometres and average cost per tonne was also negative, with the exception of farm trucks in the over 7,662 tonne-kilometres category. The relationship between total tonne-kilometres and average cost per grain-kilometre was also negative; that is, as tonne-kilometre service increased, average unit costs decreased.

Average total grain transportation costs exhibited a positive relationship with average tonne-kilometres; that is, with the increase in tonne-kilometres, average total grain transportation costs also increased. The average total tonnes transported, average total grain-kilometres, and the one-way distance to the elevator showed upward trends when studied in relationship to total tonne-kilometres.

TABLE 11

RELATIONSHIP BETWEEN TOTAL TONNES TRANSPORTED AND GRAIN TRANSPORTATION COSTS, ALBERTA

	Tonnes Transported							
	0-95.0	95.1-190.0	190.1-286.0	286.1-381.0	381.1-476.0	476.1 571.0	Over 571.0	All Trucks
Average Total Tonnes Transported	54.5	140.2	244.0	333.3	422.8	515.9	905.1	407.6
Number in Sample	74	79	81	84	45	46	123	532
Average Cost/Tonne (cents)	592	505	451	410	396	328	295	353
Average Cost/Tonne-Kilometre (cents)	37.37	26.00	22.44	19.69	16.64	15.54	14.08	16.83
Average Cost/Grain-Kilometre (cents)	110.99	90.16	93.46	84.80	84.12	76.11	83.10	84.91
Average Total Grain Transported Costs ($)	321.89	708.27	1099.71	1366.00	1674.82	1684.00	2669.57	1437.56
Fixed Cost as Per cent of Total Grain Transportation Costs	37.57	40.41	42.68	40.49	43.51	38.23	40.33	40.65
Average Total Tonne-Kilometres	861	2 724	4 900	6 938	10 062	10 836	18 977	8 542
Average Total Grain-Kilometres	290	786	1 177	1 611	1 991	2 212	3 212	1 693
Average Annual Truck Kilometres	1 919	3 899	5 029	5 153	6 690	7 300	8 313	5 544

TABLE 12

RELATIONSHIP BETWEEN TOTAL TONNE-KILOMETRES AND GRAIN TRANSPORTATION COSTS, ALBERTA

	Tonne-Kilometres						
	0-766.0	766.1-1532.0	1532.1-3065.0	3065.1-5746.0	5746.1-7662.0	Over 7662.0	All Trucks
Average Total Tonne-Kilometres	422	1 104	2 290	4 290	6 657	18 113	8 542
Number in Sample	44	53	79	110	56	190	532
Average Cost/Tonne (cents)	466	422	321	316	312	370	353
Average Cost/Tonne-Kilometre (cents)	58.76	45.23	29.29	25.33	20.04	13.95	16.83
Average Cost/Grain-Kilometre (cents)	152.77	142.13	107.67	100.7	84.04	77.69	84.91
Average Total Grain Transportation Costs ($)	248.15	499.33	670.67	1087.02	1344.21	2527.00	1437.56
Fixed Cost as Per cent of Total Grain Transportation Costs	36.79	43.03	41.03	37.71	34.88	38.17	37.90
Average Total Tonnes Transported	53.3	118.2	208.8	344.4	427.7	683.8	407.6
Average Total Grain-Kilometres	162	351	623	1 079	1 588	3 253	1 693
Average One-Way Distance to Elevator (kilometres)	11.2	11.5	11.9	13.1	16.9	20.1	15.5

Costs of Transporting Grain by Commercial/Custom Trucks

The questionnaire used for surveying included a few questions regarding the use of commercial and custom truckers for transporting grain to the primary elevators and other market outlets. Ten of the respondents indicated that they hauled grain for other grain producers besides hauling their own grain to various market outlets. Another (28) study participants reported that they hired the services of custom haulers to have their grain transported to primary elevators and other market outlets. Seventy-three respondents reported the hiring of commercial truckers in addition to using their own trucks for delivering grain to various market outlets. Commercial truckers were mostly engaged for hauling grain longer distances.

The grain producers who used the services of commercial and/or custom truckers gave several reasons indicating their preference for commercial/custom truck use. About 47 per cent of the respondents indicated that the delivery point was too far to be considered and their trucks inadequate for hauling grain over longer distances. A little over 41 per cent reported that their own trucks were too expensive compared to commercial/custom haulers. Therefore, they hired commercial/custom truckers to deliver grain to various market outlets. About 26 per cent of the grain producers mentioned good hauling rates as the reason for using the services of commercial/custom haulers. Just under 18 per cent of the commercial/custom truck users reported that they were too busy in farm operations and could not haul their own grain.

Although the study participants were asked to give only one reason for hiring the services of commercial/custom truckers, a few of them indicated more than two reasons for hiring their services.

The rates charged by the commercial/custom truckers as reported by the study participants are presented in Table 13. There was a considerable variation in rates charged by the carriers. The shortest-haul was five kilometres and the longest haul was over 1250 kilometres, most probably to Vancouver, British Columbia. No significant relationship was found between the rates charged by custom truckers and distance to the delivery points.

TABLE 13

COMMERCIAL AND CUSTOM TRUCKING RATES PAID BY GRAIN PRODUCERS FOR HAULING GRAIN TO DELIVERY POINTS

	Distance (Kms)	Wheat	Barley	Oats	Canola	Other	Total Tonnes Commercial/ Custom Hauled
		- - -Average Charge Per Tonne (cents)- - -					
(1)	21*26	367[b]	689	-	-	-	
	35	625[a]	-	-	-	-	
Southern	48-88	570[b]	-	-	-	-	2 456.2
	64-72	588[b]	505[a]	-	-	546[a]	
	80 *	-	-	-	441[a]	840	
	121*	-	493[a]	-	-	-	
(2)	5-11	367	505	-	309	-	
	19-24	505	551	-	441	-	
South-	29	426	812	-	-	504	4 090.9
western	48*56	-	712	713	617	-	
	72*	-	827	-	-	-	
	96	-	551	-	-	756	
	160	-	919[a]	-	-	630	
	343-370	-	-	-	1367	-	
(3)	6*	441	-	-	-	-	
	19-26	478	735	-	-	-	
South-	32-40	551[a]	689[a]	-	-	-	1 450.8
eastern	48 *	514	574	-	-	-	
	128*	919	-	-	-	-	
	160*177	-	735	-	705	-	
	193	-	-	-	1102	-	
	225-241	-	-	-	-	1155[a]	
(4)	12-16	524[b]	-	-	529[b]	-	
	24-32	404[b]	528	908	500[b]	-	
East-	34-40	404[a]	-	-	661[b]	-	3 943.4
central	64-80	-	-	-	675[b]	-	
	88-104	-	689	-	794	-	
	128*	-	551	-	-	-	
	160	-	-	-	1102	-	
	192	-	-	-	1014[b]	-	
	201-209	-	-	-	985[b]	-	
	233-249	-	-	-	1261	-	
	282-290	-	-	-	1477	-	

TABLE cont'd

	Distance (Kms)	Wheat	Barley	Oats	Canola	Other	Total Tonnes Commercial/ Custom Hauled
		- - -Average Charge Per Tonne (cents)- - -					
(5)	10-16	-	459[b]	-	-	-	
	24-32	-	459[b]	-	-	-	
West-	34-48	367	918	-	-	-	3 876.3
central	121*127	-	-	-	750[b]	-	
	144	-	-	-	1058	-	
	193-210	-	-	-	1268[b]	-	
	241*248	-	1148	-	1653	-	
	370	-	-	-	1102	-	
(6)	13-24	-	337[b]	-	441[a]	-	
	32	441	505[b]	-	-	-	
North-	56-64	-	-	-	882	-	1 614.3
eastern	80-96	-	-	-	1088	-	
	121*	-	-	-	397	-	
	209*225	-	-	-	1323[b]	-	
	249*	-	-	-	617[a]	-	
	480*	-	-	-	1234	-	
	1287*	3968	-	-	-	-	
(7)	6-16	367	367	-	-	-	
	18*24	404[b]	459[a]	648[b]	-	-	
North-	56	-	-	-	573	-	3 332.1
western	121*140	-	-	-	1036[b]	-	
	177	-	-	-	882	-	

Rates charged by commercial truckers unless otherwise noted.
* Indicates that information was provided by one case only.
a) Indicates custom hauler rates.
b) Indicates average rate with mixture of custom hauler and commerical trucker rate

SECTION V

AVERAGE COST OF TRANSPORTING GRAIN BY FARM TRUCKS IN SOUTHERN DISTRICT - NO.3

Total Costs of Grain Transportation

All of the cost components presented in Table 14, except for driving labor and dead-haul labor, have been weighted by grain-kilometres as a proportion of total annual truck kilometres. Thus the costs shown in Table 14 except driving and dead-haul labor, are not total annual costs for trucks, rather, these are the portions of all costs attributable to transportation of grain from farm to primary elevators and other sales outlets.[5]

The total grain transportation cost per farm truck were calculated to be $1,250.57 during the 1983-84 crop year. Total fixed cost per truck amounted to $507.74 or 40.6 per cent of the total grain transportation costs.

The largest component of grain transportation costs in the southwestern district was interest on investment, which accounted for 19.4 per cent of the total costs. This was followed by depreciation, driving labor, fuel, and dead-haul labor.

On the whole, the 90 farm grain trucks reported in southwestern districts carried 360 tonnes of grain to primary elevators and other sales outlets. In terms of tonne-kilometres, the trucks in the sample for this district provided 7,193 tonne-kilometres of service in transporting grain from farm to primary elevators and other sales outlets. Utilization of farm trucks during the 1983-84 crop year in terms of distance travelled for transporting grain was 1,515 grain-kilometres.

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5 Other sales outlets include seed plants, feed mill, crushing plants, feed lot and delivery to other farms.

TABLE 14

AVERAGE TOTAL COSTS OF TRANSPORTING GRAIN PER FARM TRUCK

IN SOUTHERN DISTRICT - NO.1, ALBERTA

Variable Costs

	Lubric	Parts	Tires and Batteries	Maintenance and Repair Labor	Fuel	Driving Labor	Dead-Haul Labor	Total Variable Costs
Dollars	19.67	105.92	67.00	39.21	196.40	167.23	147.40	742.83
Per cent	1.57	8.47	5.36	3.14	15.70	13.37	11.79	59.40

Fixed Costs

	Depreciation	Interest on Investment	License	Insurance	Fixed Costs	Total Grain Transportation Costs
Dollars	206.39	242.77	12.71	45.97	507.74	1250.57
Per cent	16.49	19.41	1.02	3.68	40.60	100.00

Unit Costs of Transporting Grain by Farm Truck

Three types of average costs were calculated to present a unit basis, the units being tonne, tonne-kilometre, and the grain-kilometres.

The average costs for each unit for southwestern district are shown in Table 15. The costs were divided into average variable costs and average fixed costs.

The average cost for transporting a tonne of grain was calculated to be 347 cents. The average variable cost per tonne was 206 cents and average fixed cost per tonne was 141 cents. On a per tonne-kilometre basis, the average cost amounted to 17.39 cents for transporting grain from farm to primary elevators and other sales outlets. The average variable cost per tonne-kilometre was 10.33 cents, and average fixed cost per tonne-kilometre was 7.06 cents.

On a grain-kilometre basis, average cost of transporting an average load of grain one kilometre was 82.54 cents. Average variable cost per grain-kilometre was 49.02 cents, and average fixed cost per grain-kilometre was 33.52 cents.

The unit costs on a per bushel, bushel-miles, and grain-mile basis are presented in bracket in Table 15.

Cost of Transporting Grain and Its Relationship With Size and Age of Truck

Size of Truck:

As farm trucks vary considerably in size, a cost analysis by size of truck was considered essential. The size of truck was measured in (i) gross vehicle weight (kgs), and capacity of grain box in tonnes.

The relationship between gross vehicle weight and average unit-costs is shown in Table 16. The average cost per tonne ranged from 282 cents for trucks in the category of up to 10,000 kilograms to 456 cents for trucks in the category of 10,001 to 12,000 kilograms gross vehicle weight. For trucks with GVW of 12,000-14,000 kg, the average cost per tonne was 374 cents, it decreased 309 cents for trucks in over 14,000 GVW group.

TABLE 15

UNIT COSTS OF TRANSPORTING GRAIN BY FARM TRUCK IN

SOUTHERN DISTRICT - NO.1, ALBERTA

Units	Average Variable Cost	Average Fixed Cost	Average Cost
	Cents	Cents	Cents
Tonne* (Bushel)	206 (4.90)	141 (3.36)	347 (8.26)
Tonne-Kilometre** (Bushel-Mile)	10.33 (0.38)	7.06 (0.27)	17.39 (0.65)
Grain-Kilometre (Grain-Mile)	49.02 (78.87)	33.52 (53.93)	82.54 (132.80)

* 1 tonne = 42 bushels
** 1 kilometre = 0.6216 miles

TABLE 16

RELATIONSHIP BETWEEN SIZE OF TRUCK (MEASURED BY GROSS VEHICLE WEIGHT) AND GRAIN TRANSPORTATION COSTS, SOUTHERN DISTRICT - NO.1, ALBERTA

	Gross Vehicle Weight in Kilograms*				
	0-10,000	10,001-12,000	12,001-14,000	Over 14,000	All Trucks
Average Size of Truck (Kg)	8 800	11 000	13 000	18 700	14 000
Number in Sample	11	14	36	29	90
Average Cost/Tonne (cents)	282	456	374	308	347
Average Cost/Tonne-Kilometre (cents)	28.92	18.54	22.75	13.05	17.39
Average Cost/Grain-Kilometre (cents)	106.78	70.24	89.23	78.55	82.54
Average Total Grain Transportation Costs ($)	604.76	1126.47	1286.62	1510.62	1250.57
Fixed Cost as Per cent of Total Grain Transportation Costs	34.87	38.15	44.28	38.47	40.60
Average Total Tonnes Transported	214.6	247.0	344.0	490.0	360.0
Average Total Tonne-Kilometres	2 091	6 076	5 655	11 577	7 193
Average Total Grain-Kilometres	566	1 604	1 442	1 923	1 515

Average cost per tonne did not exhibit a negative relationship with gross vehicle weight as hypothesized. The negative relationship would have indicated that average cost per tonne would decrease as the gross vehicle weight increased. However, average cost per tonne-kilometre and grain-kilometre did show a negative relationship with gross vehicle weight of farm trucks.

The relationship between the capacity of the grain box in tonnes (a measure of size of truck) and average cost per tonne was negative (Table 17). Average cost per tonne ranged from 467 cents for trucks with box capacity of up to 7 tonnes to 301 cents for trucks with box capacity of over 9.5 tonnes. The average cost per tonne-kilometre ranged from 26.95 cents for trucks up to 7 tonnes' grain box capacity to 14.10 cents for trucks with a grain box capacity of over 9.5 tonnes. The negative relationship between capacity of grain box in tonnes and average cost per tonne-kilometre showed that as the capacity of the grain box increased, the average unit cost per tonne-kilometre decreased. Total grain transportation costs showed an upward trend when studied in relationship to the capacity of the grain box in tonnes. In other words total costs increased as size of truck increased.

Age of Truck:

The relationship between age of truck and average cost per tonne was not consistent (Table 18). Average cost per tonne ranged from 254 cents for trucks in the age group of 1964 and older to 375 cents for trucks in 1965-69 age group. However, average costs per tonne-kilometre and per grain-kilometre showed a positive relationship with age of truck, with the exception of trucks in the 1970-74 age group. In other words, average unit costs per tonne-kilometre and grain-kilometre increased with the decrease in age of farm truck (newer trucks).

As expected, fixed cost as a per cent of total grain transportation costs were higher for newer trucks than for older trucks. Utilization of farm trucks measured in terms of tonnes transported, tonne-kilometres, and grain-kilometres showed that newer trucks had higher utilization over the older models.

TABLE 17

RELATIONSHIP BETWEEN SIZE OF TRUCK (MEASURED BY CAPACITY OF GRAIN BOX IN TONNES) AND GRAIN TRANSPORTATION COSTS, SOUTHERN DISTRICT - NO.1, ALBERTA

	Capacity of Grain Box in Tonnes			
	0-7.0	7.1-9.5	Over 9.5	All Trucks
Average Capacity of Grain Box (t)	5.7	7.9	12.9	8.9
Number in Sample	22	40	28	90
Average Cost/Tonne (cents)	467	367	301	347
Average Cost/Tonne-Kilometre (cents)	26.95	19.15	14.10	17.39
Average Cost/Grain-Kilometre (cents)	79.72	75.74	93.33	82.54
Average Total Grain Transportation Costs ($)	734.64	1287.53	1603.09	1250.57
Fixed Cost as Per cent of Total Grain Transportation Costs	40.66	37.76	43.84	40.60
Average Total Tonnes Transported	157.2	350.5	533.0	360.0
Average Total Tonne-Kilometres	2 726	6 724	11 372	7 193
Average Total Grain-Kilometres	922	1 700	1 718	1 515

TOTAL 18

RELATIONSHIP BETWEEN AGE OF TRUCK AND GRAIN TRANSPORTATION COSTS, SOUTHERN DISTRICT - NO.1, ALBERTA

	Year of Truck					
	1964 And Older	1965-1969	1970-1974	1975-1979	1980-1984	All Trucks
Average Year of Truck	1958	1967	1973	1977	1981	1972
Number in Sample	12	15	21	27	15	90
Average Cost/Tonne (cents)	254	375	353	338	371	347
Average Cost/Tonne-Kilometre (cents)	15.12	16.79	15.83	16.74	21.12	17.39
Average Cost/Grain-Kilometre (cents)	68.69	75.48	71.77	84.36	101.80	82.54
Average Total Grain Transportation Cost ($)	560.54	955.27	1218.73	1312.01	2031.76	1250.57
Fixed Cost as Per cent of Total Grain Transportation Costs	25.18	30.06	31.32	42.64	54.39	40.60
Average Total Tonnes Transported	220.3	254.5	345.3	387.6	548.3	360.0
Average Total Tonne-Kilometres	3 708	5 690	7 698	7 835	9 621	7 193
Averge Total Grain-Kilometres	816	1 266	1 698	1 555	1 996	1 515
Average Annual Truck Kilometres	3 325	3 854	6 038	6 140	8 549	5 761

Trucks in 1980-84 age group showed the highest level of utilization compared to trucks in other categories.

Details on unit costs, total costs and utilization levels of trucks are presented in Table 18.

Relationship Between One-Way Distance to Elevator and Grain Transportation Costs

The average cost per tonne did not show a consistent trend when studied in relationship to one-way distance to the primary elevator (Table 19). Similarly, other unit costs (per tonne-kilometre and per grain-kilometre) did not show a consistent trend or relationship either. It was hypothesized that average unit costs per tonne-kilometre and grain-kilometre would show a downward trend with the increase in one-way distance to the elevator, because on longer hauls overhead costs get better distributed.

As shown in Table 19, no discernable relationship existed between different levels of truck utilization and the one-way distance to elevator.

Relationship Between Size of Farm, Annual Truck-Kilometres, Tonnes Transported, Tonne-Kilometres, and Grain Transportation Costs

Size of Farm:

The relationship between size of farm and the average unit costs is presented in Table 20. Average cost per tonne ranged from 287 cents for trucks in 0 to 640 acres group to 382 cents for trucks in the 961 to 1,280 acres category. Average cost per tonne-kilometre was the lowest at 11.77 cents for trucks on up to 640 acre farms. It increased to 23.17 cents for trucks on 961 to 1,280 acre group and decreased to 16.14 cents for the next group. Average cost per tonne-kilometre was 17.51 cents for trucks in the over 1,600 acre group.

TABLE 19

RELATIONSHIP BETWEEN ONE-WAY DISTANCE TO ELEVATOR AND GRAIN TRANSPORTATION COSTS, SOUTHERN DISTRICT - NO.1, ALBERTA

	One-Way Distance to Elevator in Kilometres					
	0-11.0	11.1-15.0	15.1-19.0	19.1-23.0	Over 23.1	All Trucks
Average One-Way Distance to Elevator (kilometres)	7.2	12.1	16.7	19.9	32.2	14.1
Number in Sample	43	19	5	8	15	90
Average Cost/Tonne (cents)	287	301	345	531	5.27	347
Average Cost/Tonne-Kilometre	22.96	14.28	17.33	19.19	14.22	17.39
Average Cost/Grain-Kilometre	99.63	83.16	76.41	84.28	65.85	82.54
Average Total Grain Transportation Costs ($)	1031.37	1154.90	1774.78	1099.72	1905.73	1250.57
Fixed Cost as Per cent of Total Grain Transportation Costs	44.46	29.96	36.85	42.58	43.35	40.60
Average Total Tonnes Transported	359.6	383.9	514.0	207.3	361.1	360.0
Average Total Tonne-Kilometres	4 491	8 807	10 239	6 046	13 401	7 193
Average Total Grain-Kilometres	1 035	1 389	2 323	1 305	2 894	1 515
Average Annual Truck Kilometres	4 176	6 876	6 154	5 813	8 734	5 761

TABLE 20

RELATIONSHIP BETWEEN SIZE OF FARM IN ACRES AND GRAIN TRANSPORTATION COSTS,

SOUTHERN DISTRICT - NO.1, ALBERTA

	Size of Farm in Acres					
	0-640	641-960	961-1280	1281-1600	Over 1600	All Trucks
Average Size of Farm In Acres	336	871	1 218	1 476	2 946	1 777
Number in Sample (grain trucks)	18	17	9	5	41	90
Average Cost/Tonne (cents)	287	362	382	372	351	347
Average Cost/Tonne-Kilometres (cents)	11.77	22.09	23.17	16.14	17.51	17.39
Average Cost/Grain-Kilometre (cents)	65.70	108.63	93.32	61.20	82.77	82.54
Average Total Grain Transportation Costs ($)	731.33	1212.96	902.92	1547.52	1534.18	1250.57
Fixed Cost as Per cent of Total Grain Transportation Costs	37.45	41.60	51.56	28.62	40.99	40.60
Average One-Way Distance to Elevator (kilometres)	9.9	13.0	14.1	15.8	16.1	14.1
Average Total Tonnes Transported	255.2	335.4	236.5	416.4	436.5	360.0
Average Total Tonne-Kilometres	6 212	5 492	3 897	9 587	8 761	7 193
Grain Kilometres as Per cent of Annual Truck Kilometres	21.73	27.63	15.86	27.10	29.68	26.29
Average Annual Truck Kilometres	5 122	4 041	6 101	9 332	6 245	5 761

The average cost per grain-kilometre ranged from 61.20 cents for trucks in the 1,281-1,600 acre group to 108.63 cents for trucks in the 641-960 acre category.

Total grain transportation costs showed a positive relationship when studied in relationship to size of farm in acres with the exception of trucks in the 961 to 1,280 acre group. A positive relationship indicated that total grain transportation costs increased with the increase in the size of farm in acres. Farm trucks on larger sized farms had a significantly higher level of utilization when measured in terms of tonnes of grain transported and tonne-kilometres of service provided (Table 20).

Annual Truck Kilometres:

Average annual truck kilometres is another measure of truck utilization, i.e., annual distance travelled by a truck. When this measure was studied in relationship to average cost per tonne-kilometre, a negative relationship was found (Table 21). That is, as annual truck kilometres (mileage) increased, average cost per tonne-kilometre of transporting grain decreased. Average cost per tonne and average cost per grain-kilometre did not show any discernable relationship with average annual truck kilometres.

Average annual grain transportation costs showed a positive relationship with annual truck kilometres, i.e., total grain transportation costs increased with the increase in annual truck kilometres, with an exception of trucks in the 4,828 to 7,240 annual truck kilometres. A similar trend was observed for other measures of truck utilization, i.e., tonnes of grain transported and average total tonne-kilometres.

Farm trucks in 7,241 to 9,654 and over 9,654 kilometres groups showed the highest level of utilization, in terms of tonnes of grain transported and average total tonne-kilometres. Fixed cost as a per cent of total grain transportation costs did not exhibit any consistent relationship with average annual truck kilometres.

TABLE 21

RELATIONSHIP BETWEEN ANNUAL TRUCK MILEAGE AND GRAIN TRANSPORTATION COSTS, SOUTHERN DISTRICT - NO.1, ALBERTA

	Annaul Truck Kilometres						
	0-1 609	1 610-3 218	3 219-4 827	4 828-7 240	7 241-9 654	Over 9 654	All Trucks
Average Annual Truck Kilometres	1 287	2 904	4 397	6 206	8 277	16 412	5 761
Number in Sample	15	22	16	7	21	9	90
Average Cost/Tonne (cents)	508	485	282	307	335	308	347
Average Cost/Tonne-Kilometre (cents)	55.06	27.62	25.57	14.61	13.26	11.01	17.39
Average Cost/Grain-Kilometre (cents)	217.36	111.29	113.17	54.32	71.46	56.76	82.54
Average Total Grain Transportation Costs ($)	628.58	1035.64	1316.51	1287.61	1602.56	1845.06	1250.57
Fixed Cost as Per cent of Total Grain Transportation Costs	54.76	52.75	38.30	30.28	33.51	38.78	40.60
Average Total Tonnes Transported	123.8	213.5	467.1	419.6	478.7	598.3	360.0
Average Total Tonne-Kilometres	1 142	3 749	5 148	8 815	12 086	16 654	7 193
Grain-Kilometres as Per cent of Annual Truck Kilometres	22.47	32.05	26.46	38.19	27.09	19.81	26.29

Tonnes Transported:

The relationship between average costs per tonne, tonne-kilometre, grain-kilometre and average total tonnes of grain transported was not as expected (Table 22). It was hypothesized that average unit costs would be lower for trucks hauling more grain to primary elevators and other sales outlets. The relationship between the unit costs and tonnes of grain transported was not consistent. Although trucks in the over 571 tonne category showed the lowest cost per tonne at 264 cents, the average unit cost per tonne-kilometre was the lowest for trucks in the 381.1 to 476 tonnes category at 10.51 cents, which also showed the lowest cost (63.88 cents) per grain-kilometre.

Tonne-Kilometres:

The relationship between total tonne-kilometres (a measure of truck utilization) and average cost per tonne was almost negative (Table 23), with an exception for trucks in over 7,662 tonne-kilometres which showed a somewhat higher cost than expected. Average cost per tonne ranged from 286 cents for trucks in 5,746 to 7,662 tonne-kilometres group to 710 cents for trucks in up to 766 tonne-kilometre category.

As expected, the relationship between average cost per tonne-kilometre and total tonne-kilometres of grain service provided was negative. This negative relationship supported the hypothesis that as tonne-kilometres increased, average cost per tonne-kilometre decreased. More or less, a similar relationship was observed between average cost per grain-kilometre and total tonne-kilometres.

A positive relationship was observed between total tonne-kilometres and total grain transportation cost. Average tonnes transported and average grain-kilometres (two different measures of truck utilization) also exhibited a positive relationship when studied with total tonne-kilometres (Table 23).

TABLE 22

RELATIONSHIP BETWEEN TOTAL BUSHELS TRANSPORTED AND GRAIN TRANSPORTATION COSTS,

SOUTHERN DISTRICT - NO.1, ALBERTA

	Tonnes Transported							
	0-95.0	95.1-190.0	190.1-286.0	286.1-381.0	381.1-476.0	476.1-571.0	Over 571	All Trucks
Average Total Tonnes Transported	2 582	5 948	10 197	13 833	17 877	21 355	41 068	360.0
Number in Sample	14	16	15	15	9	6	15	90
Average Cost/Tonne (cents)	617	487	591	335	301	344	264	347
Average Cost/Tonne-Kilometre (cents)	33.86	25.42	26.72	17.37	10.50	16.92	15.01	17.39
Average Cost/Grain-Kilometre (cents)	101.62	98.75	107.11	69.21	63.88	71.18	83.46	82.54
Average Total Grain Transportation Costs ($)	386.36	674.90	1410.00	1103.49	1243.37	1673.37	2493.95	1250.57
Fixed Cost as Per cent of Total Grain Transportation Costs	36.19	50.81	43.27	29.06	45.50	37.87	41.16	40.60
Average Total Tonne-Kilometres	1 141	2 655	5 277	6 354	11 846	9 892	16 566	7 193
Average Total Grain-Kilometres	380	683	1 316	1 594	1 947	2 351	2 933	1 515
Average Annual Truck Kilometres	2 712	3 761	4 830	7 350	8 403	6 168	8 335	5 761

TABLE 23

RELATIONSHIP BETWEEN TOTAL BUSHEL-MILES AND GRAIN TRANSPORTATION COSTS,

SOUTHERN DISTRICT - NO.1, ALBERTA

	Total Tonne-Kilometres						
	0-766.0	766.1 - 1532.0	1532.1-3065.0	3065.1-5746.0	5746.1-7662.0	Over 7662.0	All Trucks
Average Total Tonne-Kilometres	468	1 056	2 259	4 205	6 644	16 218	7 193
Number in Sample	6	12	15	20	9	28	90
Average Cost/Tonne (cents)	710	379	367	357	286	345	347
Average Cost/Tonne-Kilometres (cents)	74.38	36.75	34.57	27.30	18.43	13.24	17.39
Average Cost/Grain-Kilometre (cents)	191.51	107.57	135.91	107.44	88.31	67.94	82.54
Average Total Grain Transportation Costs ($)	348.20	388.29	781.11	1147.88	1224.52	2146.64	1250.57
Fixed Cost as Per cent of Total Grain Transportation Costs	36.66	40.87	53.45	37.69	35.19	40.31	40.60
Average Total Tonnes Transported	49.0	102.6	212.8	321.6	428.0	621.4	360.0
Average Total Grain-Kilometres	182	361	575	1 068	1 387	3 160	1 515
Average One-Way Distance to Elevator (kilometres)	11.2	11.5	11.9	13.1	16.9	20.1	14.1

SECTION VI

AVERAGE COST OF TRANSPORTING GRAIN BY FARM TRUCK IN SOUTHWESTERN DISTRICT - NO.2

Total Cost of Grain Transportation

All of the cost components presented in Table 24, except for driving labor and dead-haul labor, have been weighted by grain-kilometres as a proportion of total annual truck-kilometres. Thus, the cost shown in Table 24, except driving and dead-haul labor, are not the total annual costs for the truck, rather, these are the portions of all costs attributable to the transportation of grain from the farm to the country elevator and other sales outlets.[6]

The total grain transportation costs per farm truck in the southwestern district was calculated to be $1341.32 for the 1983-84 crop year. The total fixed cost per truck amounted to $571.74 or 42.63 per cent of total grain transportation costs.

The largest component of grain transportation costs was interest on investment, which accounted for 20.52 per cent of the total costs. This was followed by depreciation (16.59 per cent), fuel (15.04 per cent), dead-haul labor (13.61 per cent), and driving labor (13.48 per cent).

On the whole, the 74 grain trucks reported in southwestern district (No.2) carried 29,045 tonnes of grain to primary elevators and other sales outlets. In terms of tonne-kilometres, these trucks in the sample provided 533,762 tonne-kilometres of service in transporting grain from farm to country elevators and other sales outlets in this district.

Unit Costs of Transporting Grain by Farm Truck

Three types of average costs were calculated to present a unit basis, the units being the tonne, tonne-kilometre and the grain-

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6 Other sales outlets include seed plants, feed mills, crushing plants, feedlots, and delivery to other farmers.

TABLE 24

AVERAGE TOTAL COSTS OF TRANSPORTING GRAIN PER FARM TRUCK

IN SOUTHWESTERN DISTRICT - NO.2, ALBERTA

Variable Costs

	Lubric	Parts	Tires and Batteries	Maintenance and Repair Labor	Fuel	Driving Labor	Dead-Haul Labor	Total Variable Costs
Dollars	18.30	90.85	51.27	44.06	201.75	180.78	182.57	769.58
Per cent	1.36	6.77	3.82	3.29	15.04	13.48	13.61	57.37

Fixed Costs

	Depreciation	Interest on Investment	License	Insurance	Fixed Costs	Total Grain Transportation Costs
Dollars	222.49	275.21	13.90	60.14	571.74	1341.32
Per cent	16.59	20.52	1.04	4.48	42.63	100.00

kilometre. The average costs for each unit for southwestern district are shown in Table 25. The costs were divided into average variable costs and average fixed costs.

The average cost per tonne of transporting grain was calculated to be 342 cents. The average variable cost per tonne was 196 cents and the average fixed cost per tonne was 146 cents. On a tonne-kilometre basis, the average cost of transporting a tonne of grain a kilometre amounted to 18.60 cents. The average variable cost per tonne-kilometre was 10.67 cents, and average fixed cost per tonne-kilometre was 7.93 cents.

On a grain-kilometre basis, the average cost of transporting an average load of grain one kilometre was 84.95 cents. The average variable cost per grain-kilometre was 48.74 cents, and the average fixed cost per grain-kilometre was 36.21 cents.

Average unit costs in terms of per bushel, per bushel-mile, and per grain-mile are present in brackets in Table 25.

Cost of Transporting Grain and Its Relationship With Size and Age of Truck

Size of Truck:

The size of truck was measured in (i) gross vehicle weight (kilograms) and (ii) capacity of grain box in tonnes.

The relationship between size of truck measured by gross vehicle weight (GVW) in kilograms and average cost per tonne appeared to be positive. Average cost per tonne ranged from 300 cents for trucks in the category of up to 10,000 kg (GVW) to 346 cents for trucks in 12,000 to 14,000 kg, (GVW) class. Average cost per tonne was 343 cents for trucks in the over 14 000 Kgs., group (Table 26). A positive relationship indicated that as size of farm trucks increased, average cost per tonne also increased.

Other unit costs (average cost per tonne-kilometre and per grain-kilometre) also showed the same trend. However, a lower average cost per tonne-kilometre (15.99 cents) was reported for trucks with GVW over 14,000 kg. In other words, as the size of truck increased in terms of

TABLE 25

UNIT COSTS OF TRANSPORTING GRAIN BY FARM TRUCK

IN SOUTHWESTERN DISTRICT - NO.2, ALBERTA

Units	Average Variable Cost	Average Fixed Cost	Average Cost
	Cents	Cents	Cents
Tonne* (Bushel)	196 (4.67)	146 (3.48)	342 (8.14)
Tonne-Kilometre** (Bushel-Mile)	10.67 (0.41)	7.93 (0.30)	18.60 (0.71)
Grain-Kilometre (Grain-Mile)	48.74 (78.42)	36.21 (58.26)	84.95 (136.68)

* 1 tonne = 42 bushels
** 1 kilometre = 0.6216 miles

TABLE 26

RELATIONSHIP BETWEEN SIZE OF TRUCK (MEASURED BY GROSS VEHICLE WEIGHT) AND GRAIN TRANSPORTATION COSTS, SOUTHWESTERN DISTRICT - NO.2, ALBERTA

	Gross Vehicle Weight in Kilograms				
	0-10 000	10 001-12 000	12 001-14 000	Over 14 000	All Trucks
Average Size of Truck (Kg)	8 900	11 060	12 866	19 023	13 920
Number in Sample	3	15	37	19	74
Average Cost/Tonne (cents)	300	328	346	343	342
Average Cost/Tonne-Kilometre (cents)	18.79	20.11	21.25	15.99	18.60
Average Cost/Grain-Kilometre (cents)	67.50	70.98	89.48	85.55	84.95
Average Total Grain Transportation Costs ($)	701.56	701.64	1248.90	2127.31	1341.32
Fixed Cost as Per cent of Total Grain Transportation Costs	25.82	35.41	45.71	41.86	42.63
Average Total Tonnes Transported	233.5	214.0	361.2	619.6	392.5
Average Total Tonne-Kilometres	3 734	3 489	5 876	13 304	7 213
Average Total Grain-Kilometres	1 039	989	1 396	2 487	1 579

GVW, average cost per tonne-kilometre decreased. This was not the case for the first three groups of trucks as average unit costs increased with the increase in size of trucks. The positive relationship which was contrary to the hypothesis can be attributed to a relatively lower level of truck utilization. Otherwise, under a normal situation unit costs when measured in terms of size of truck in GVW should show a downward trend, i.e., a negative relationship with size of truck.

Details on total grain transportation costs, fixed costs as a per cent grain transportation costs, total tonnes transported, tonne-kilometres, and average total grain-kilometres are presented in Table 26.

The relationship between size of truck measured by capacity of grain box in tonnes and average unit costs is presented in Table 27. Average cost per tonne was 447 cents for trucks in up to 7 tonne (box capacity) group. It decreased to 321 cents for trucks in 7.1 to 9.5 tonne box capacity group. Average cost per tonne increased to 344 cents for trucks in the over 9.5 tonnes category. The average for the sample in the southwestern district was 342 cents per tonne.

The relationship between capacity of grain box in tonnes and average cost per tonne-kilometre was negative (Table 27). In other words, as size of grain box increased, average cost per tonne-kilometre decreased. This relationship supported the hypothesis that average unit costs would decrease with the increase in size of truck.

Age of Truck:

The relationship between age of truck and average cost per tonne was not consistent as shown by the results in Table 28. Average cost per tonne range from 269 cents for trucks in 1965-69 group to 392 cents for trucks in the 1980-84 group. As expected, new trucks (1980-84) showed the highest unit cost per tonne at 392 cents.

TABLE 27

RELATIONSHIP BETWEEN SIZE OF TRUCK (MEASURED BY CAPACITY OF GRAIN BOX IN BUSHELS) AND GRAIN TRANSPORTATION COSTS, SOUTHWESTERN DISTRICT - NO.2, ALBERTA

	Capacity of Grain Box in Tonnes			
	0-7.0	7.1-9.5	Over 9.5	All Trucks
Average Size of Truck (t)	289	357	523	8.5
Number in Sample	17	39	18	74
Average Cost/Tonne (cents)	447	321	344	342
Average Cost/Tonne-Kilometre (cents)	28.77	20.18	15.33	18.60
Average Cost/Grain-Kilometre (cents)	76.79	84.52	88.55	84.95
Average Total Grain Transportation Costs ($)	720.55	1249.98	2125.51	1341.32
Fixed Cost as Per cent of Total Grain Transportation Costs	41.72	38.03	48.77	42.63
Average Total Tonnes Transported	161.3	389.2	618.2	392.5
Average Total Tonne-Kilometres	2 505	6 194	13 867	7 213
Average Total Grain-Kilometres	938	1 479	2 400	1 579

RELATIONSHIP BETWEEN AGE OF TRUCK AND GRAIN TRANSPORTATION COSTS,

SOUTHERN DISTRICT - NO.2, ALBERTA

	Year of Truck					
	1964 And Older	1965-1969	1970-1974	1975-1979	1980-1984	All Trucks
Average Year of Truck	1962	1967	1973	1977	1981	1974
Number of Sample	6	11	17	26	14	74
Average Cost/Tonne (cents)	292	269	339	326	392	342
Average Cost/Tonne-Kilometre (cents)	8.46	15.66	20.58	22.07	18.16	18.60
Average Cost/Grain-Kilometre (cents)	46.77	63.46	82.50	88.91	94.43	84.95
Average Total Grain Transportation Cost ($)	646.70	728.88	1051.67	1289.97	2567.97	1341.32
Fixed Cost as Per cent of Total Grain Transportation Costs	22.53	23.77	34.09	44.39	51.52	42.63
Average Total Tonnes Transported	221.2	271.4	310.0	395.4	655.9	392.5
Average Total Tonne-Kilometres	7 642	4 653	5 110	5 842	14 137	7 213
Averge Total Grain-Kilometre	1 383	1 149	1 275	1 450	2 609	1 579
Average Annual Truck Kilometres	3 325	4 185	4 241	4 641	6 557	4 737

The average cost per tonne-kilometre exhibited a positive relationship with age of truck, except for trucks in the 1980-84 groups, for which the unit cost decreased. Positive relationships indicated that the average unit cost per tonne-kilometre increased with the age of truck, i.e., newer trucks had a higher unit cost (Table 28).

The average cost per grain-kilometre showed a positive relationship (as hypothesized) when studied with age of truck. The average cost per grain-kilometre was the lowest (46.77 cents) for trucks in the 1964 and older group, and the highest (94.43 cents) for trucks in the 1980-1984 group Table 28.

Total grain transportation costs and fixed costs as per cent of total costs showed a positive relationship with age of truck. Details on total tonnes transported, total tonne-kilometres, and grain-kilometres, etc. are provided in Table 28.

Relationship Between One-Way Distance to Elevator and Grain Transportation Costs

The relationship between one-way distance to elevator and average unit costs per tonne, per tonne-kilometre, and per grain-kilometre is presented in Table 29. Average cost per tonne increased from 266 cents for trucks in 0-11 kilometre category to 540 cents for trucks in the over 23 kilometre group. In other words, average cost per tonne increased with the increase in one-way distance to elevator.

The average cost per tonne-kilometre did not show a consistent relationship when studied with one-way distance to elevator. It was hypothesized that the average cost per tonne-kilometre would decrease as one-way distance to elevator increased. However, such a relationship could not be observed because of different levels of truck utilization among grain producers. The average cost per tonne-kilometre ranged from 14.92 cents for trucks in 15.1-19.0 kilometres group to 22.74 cents for trucks in over 23 kilometres group (Table 29).

The average cost per grain-kilometre exhibited a negative relationship with one-way distance to elevator, with the exception of trucks in 19.1 to 23 kilometre category. A negative relationship indicated that

TOTAL 29

RELATIONSHIP BETWEEN ONE-WAY DISTANCE TO ELEVATOR AND GRAIN TRANSPORTATION COSTS,

SOUTHWESTERN DISTRICT - NO.2, ALBERTA

	One-Way Distance to Elevator in Kilometres					
	0-11.0	11.1-15.0	15.1-19.0	19.1-23.0	Over 23.0	All Trucks
Average One-Way Distance to Elevator (kilometres)	7.1	12.0	16.6	20.1	26.5	13.1
Number in Sample	26	20	9	17	2	74
Average Cost/Tonne (cents)	266	342	362	421	540	342
Average Cost/Tonne-Kilometre (cents)	21.33	21.64	14.95	17.35	22.74	18.60
Average Cost/Grain-Kilometre (cents)	101.65	93.19	73.22	78.48	63.95	84.95
Average Total Grain Transportation Costs ($)	976.96	1181.85	2270.04	1625.80	1075.21	1341.32
Fixed Cost as a Per cent of Total Grain Transportation Costs	44.45	48.94	40.47	38.39	26.55	42.63
Average Total Tonnes Transported	366.7	345.3	626.2	386.6	199.2	392.5
Average Total Tonne-Kilometres	4 580	5 461	15 182	9 373	4 728	7 213
Average Total Grain-Kilometres	961	1 268	3 100	2 072	1 681	1 579
Average Annual Truck Kilometres	3 899	4 172	7 822	5 164	3 781	4 737

the average cost per tonne-kilometre decreased as the one-way distance to the elevator increased.

The relationship between one-way distance to the elevator and truck utilization characteristics (tonnes transported, tonne-kilometres, grain-kilometres, and annual truck kilometres) are given in Table 29.

Relationship Between Size of Farm, Annual Truck Kilometres, Tonnes Transported, Tonne-Kilometres, and Grain Transportation Costs

Size of Farm:

A less direct measure of truck utilization might be the size of farm in acres (Table 30). In general, one would expect that trucks would utilized more on larger farms than on smaller farms. This expectation appeared to be true, when the relationship between size of farm in acres, utilization of farm trucks in terms of tonnes of grain transported and tonne-kilometres of service provided, and grain transportation costs was examined.

It was expected that average unit costs would be lower for larger farms because of relatively higher utilization level of farm trucks in such farms. This expectation was somewhat true for trucks in the over 1,600 acres group - the largest farm size group of the study sample in the southwestern district. The average cost per tonne was the lowest for trucks in the 961-1,280 acres group at 307 cents, followed by 326 cents for trucks in the over 1,600 acres group. The average cost per tonne-kilometre and per grain-kilometre were the lowest for trucks in the over 1,600 acre group. With the exception of trucks in the up to 640 acres group, a consistent relationship was observed between size of farm in acres and tonnes of grain transported, tonne-kilometres service and average grain transportation costs.

Annual Truck Kilometres:

Annual truck kilometres (mileage) was another measure of the level of farm truck utilization used in transporting grain (Table 31). The relationship between annual truck kilometres and average cost per tonne

TABLE 30

RELATIONSHIP BETWEEN SIZE OF FARM IN ACRES AND GRAIN TRANSPORTATION COSTS, SOUTHWESTERN DISTRICT - NO.2, ALBERTA

	Size of Farm in Acres					
	0-640	641-960	961-1280	1281-1600	Over 1600	All Trucks
Average Size of Farm (acre)	580	853	1 182	1 450	3 494	1 997
Number in Sample (grain trucks)	12	13	10	9	30	74
Average Cost/Tonne (cents)	417	366	307	371	326	342
Average Cost/Tonne-Kilometres (cents)	20.55	26.36	21.18	24.28	16.03	18.60
Average Cost/Grain-Kilometres (cents)	79.48	101.69	100.43	93.43	79.26	84.95
Average Total Grain Transportation Costs ($)	926.26	782.64	1111.48	1491.99	1780.85	1341.32
Fixed Cost as Per cent of Total Grain Transportation Costs	46.29	49.86	51.28	41.62	38.93	42.63
Average One-Way Distance to Elevator (kilometres)	12.2	14.6	10.5	13.8	13.4	13.1
Average Total Tonnes Transported	222.2	214.1	361.7	402.0	545.4	392.5
Average Total Tonne-Kilometres	4 508	2 969	5 248	6 144	11 108	7 213
Grain Kilometres as Per cent of Annual Truck Kilometres	29.27	23.73	33.79	36.46	35.77	33.33
Average Annual Truck Kilometres	3 982	3 243	3 276	4 380	6 281	4 737

TABLE 31

RELATIONSHIP BETWEEN ANNUAL TRUCK KILOMETRES AND GRAIN TRANSPORTATION COSTS, SOUTHWESTERN DISTRICT - NO.2, ALBERTA

	Annual Truck Kilometres						
	0-1609	1610-3218	3219-4827	4828-7240	7241-9654	Over 9654	All Trucks
Average Annual Truck Kilometres	1 325	2 843	4 524	6 169	8 417	16 760	4 737
Number in Sample	17	15	17	12	10	3	74
Average Cost/Tonne (cents)	357	389	342	347	295	325	342
Average Cost/Tonne-Kilometre (cents)	36.32	26.29	21.60	19.45	15.37	10.49	18.60
Average Cost/Grain-Kilometre (cents)	176.99	112.78	86.10	81.57	68.44	62.14	84.95
Average Total Grain Transportation Costs ($)	522.83	1110.07	1211.26	2161.29	1273.83	4647.67	1341.32
Fixed Cost as Per cent of Total Grain Transportation Costs	59.51	49.23	47.81	34.29	38.40	35.06	42.63
Average Total Tonnes Transported	155.0	285.7	354.6	623.4	432.0	1432.1	42.63
Average Total Tonne-Kilometres	1 522	4 223	5 608	11 112	8 287	44 320	7 213
Grain-Kilometres as Per cent of Annual Truck Kilometres	23.57	34.63	31.10	42.95	22.11	44.63	33.33

was not consistent. The average cost per tonne ranged from 295 cents for trucks in the 7,241-9,654 annual kilometres group to 389 cents for trucks in 1,610-3,218 kilometres group.

The average cost per tonne-kilometre showed a negative relationship with annual truck kilometres (Table 31). That is, average cost per tonne-kilometre decreased with the increase in annual truck kilometres. This unit cost ranged from 10.49 cents for trucks in the over 9,654 annual kilometre class to 36.32 cents for trucks in up the to 1,609 annual kilometre class. The hypothesis that trucks travelling longer distances would show lower unit costs held true for trucks travelling over 9,654 kilometres annually.

The relationship between average costs per grain-kilometre and annual truck kilometres was also negative, which indicated that the unit cost decreased with the increase in annual distance travelled.

Details regarding the level of truck utilization in terms of total tonnes transported, total tonne-kilometres, and grain-kilometres as a per cent of annual truck kilometres are presented in Table 31.

Tonnes Transported:

The average cost per tonne was the highest (501 cents) for trucks transporting up to 95 tonnes of grain, and the lowest (289 cents) for those transporting between 476.1 to 571 tonnes of grain. It was expected that a negative relationship would exist between volume of grain transported and average cost per tonne. It is apparent from the results in Table 32 that trucks showing high unit costs had a higher proportion of fixed costs and were used in terms of tonne-kilometres and annual truck kilometres.

The relationship between average cost per tonne-kilometre and tonnes transported was negative with the exception of trucks in the 190.1 to 286.0 tonnes group. The hypothesis that the average cost per tonne-kilometre would decrease with the increase in tonnes transported held true and was supported by the information in Table 32. The unit cost ranged from 15.59 cents per tonne-kilometre for trucks in the over 571 tonnes group to 29.23 cents for trucks in the up to 95 tonnes category.

Average grain transportation costs increased from 268.69 for trucks delivering up to 95 tonnes of grain to $2,991.26 for those delivering over 571 tonnes. As the volume of grain transported increased, average total grain transportation costs also increased. Details on other relationships are presented in Table 32.

Tonne-Kilometres:

The average cost per tonne and tonne-kilometres did not show any discernable relationship Table 33. It was anticipated that trucks with higher tonne-kilometres of service would have lower unit costs over those with lower tonne-kilometres. However, this was not the case, as cost per tonne ranged from 308 cents for trucks in the 3,065.1-5,746 tonne-kilometres group to 429 cents for trucks in a 766.1-1,532 tonne-kilometres category.

The relationship between average cost per tonne-kilometre and total tonne-kilometres was negative with the exception of trucks in the up to 766 tonne-kilometres class. It was hypothesized that the average cost per tonne-kilometre would decrease with the increase in average total tonne-kilometres. The hypothesis was supported by the results in Table 33, as average costs per tonne-kilometre ranged from 15.75 cents for trucks in the over 7,662 tonne-kilometres group to 41.40 cents for trucks in the 766.1-1,532 tonne-kilometre group.

The relationship between average total grain transportation costs and tonne-kilometres was positive. That is, with the increase in tonne-kilometres, average grain transportation costs also increased. Fixed costs as per cent of total grain transportation costs was high for trucks showing relatively higher unit costs.

Average tonnes transported and average grain-kilometres also showed a positive relationship when examined with the average total tonne-kilometres. Details on costs and utilization levels of farm trucks are presented in Table 33.

TABLE 32

RELATIONSHIP BETWEEN TOTAL TONNES TRANSPORTED AND GRAIN TRANSPORTATION COSTS, SOUTHWESTERN DISTRICT - NO.2, ALBERTA

	Tonnes Transported							
	0-95.0	95.1-190.0	190.1-286.0	286.1-381.0	381.1-476.0	476.1-571.0	Over 571.0	All Trucks
Average Total Tonnes Transported	53.6	126.5	249.5	341.8	432.8	521.6	921.0	392.5
Number in Sample	11	11	14	9	7	7	15	74
Average Cost/Tonne (cents)	501	444	385	313	384	289	325	342
Average Cost/Tonne-Kilometre (cents)	29.23	27.43	20.46	24.40	21.69	19.39	15.59	18.60
Average Cost/Grain-Kilometre (cents)	101.04	90.92	77.64	99.55	94.06	88.61	80.34	84.95
Average Total Grain Transported Costs ($)	268.69	562.26	961.19	1068.24	1661.75	1506.45	2991.26	1341.32
Fixed Cost as Per cent of Total Grain Transportation Costs	48.40	47.82	42.78	42.09	55.70	37.48	39.42	42.63
Average Total Tonne-Kilometres	919	2 049	4 698	4 378	7 661	7 771	19 192	7 213
Average Total Grain-Kilometres	266	618	1 238	1 073	1 767	1 700	3 723	1 579
Average Annual Truck Kilometres	1 799	2 772	5 035	3 604	4 942	5 677	8 201	4 737

TABLE 33

RELATIONSHIP BETWEEN TOTAL TONNE-KILOMETRES AND GRAIN TRANSPORTATION COSTS, SOUTHWESTERN DISTRICT - NO.2, ALBERTA

	Tonne-Truck Kilometres						
	0-766.0	766.1-1532.0	1531.1-3065.0	3065.1-5746.0	5746.1-7662.0	Over 7662	All Trucks
Average Total Tonne-Kilometres	406	1 086	2 097	4 387	6 663	15 986	7 213
Number in Sample	5	8	15	17	5	24	74
Average Cost/Tonne (cents)	346	429	351	308	397	343	342
Average Cost/Tonne-Kilometre (cents)	28.01	41.40	31.63	25.05	18.13	15.75	18.60
Average Cost/Grain-Kilometre (cents)	89.25	123.32	105.72	99.49	77.93	78.12	84.95
Average Total Grain Transportation Costs ($)	113.73	449.43	663.18	1098.90	1208.19	2517.64	42.63
Fixed Cost as Per cent of Total Grain Transportation Costs	53.55	50.59	46.09	44.12	43.95	40.88	42.63
Average Total Tonnes Transported	32.9	104.7	189.1	356.9	304.5	734.1	392.5
Average Total Grain-Kilometres	127	364	627	1 105	1 550	3 223	1 579
Average One-Way Distance to Elevator (kilometres)	16.1	11.1	12.1	11.5	15.1	14.4	13.1

SECTION VII

AVERAGE TOTAL COSTS OF TRANSPORTING GRAIN BY FARM TRUCK IN SOUTHEASTERN DISTRICT - NO.3

Total Costs of Grain Transportation

All of the cost components presented in Table 34, except for driving labor and dead-haul labor, have been weighted by grain-kilometres as a proportion of total annual truck kilometres. Thus, the costs shown in Table 34 except for driving and dead-haul labor, are not the total annual costs for a farm truck, rather, these are the portions of all costs attributable to transportation of grain from farm to primary elevators and other sales outlets.

The average total grain transportation costs per farm truck in the southeastern district (No.3) are based on a sample of 86 trucks involved in transporting grain from farms to primary outlets. These costs were calculated to be $1,360.62 per farm truck during the 1983-84 crop year. The average fixed costs amounted to $571.94 per farm truck or 42.04 per cent of the total grain transportation costs (Table 34).

The largest component of grain transportation costs was interest on investment at $273.33 (20.09 per cent), driving and dead-haul labors. Details on other variable and fixed cost items are presented in Table 34.

On the whole, the 86 farm trucks reported in district No.3 carried 30,573 tonnes of grain to primary elevators and other sales outlets. In terms of tonnes-kilometres the trucks in the sample provided 705,286 tonne-kilometres of service in transporting grain from farms to primary elevators and other sales outlets.

Unit Costs of Transporting Grain by Farm Truck

Three types of average costs were calculated to present costs on a unit basis. The units used in referring to grain transporting costs are tonne, tonne-kilometre, and grain-kilometre.

TABLE 34

AVERAGE TOTAL COSTS OF TRANSPORTING GRAIN PER FARM TRUCK IN SOUTHEASTERN DISTRICT - NO.3, ALBERTA

Variable Costs

	Lubric	Parts	Tires and Batteries	Maintenance and Repair Labor	Fuel	Driving Labor	Dead-Haul Labor	Total Variable Costs
Dollars	19.83	105.59	82.45	31.35	190.21	183.38	175.87	788.68
Per cent	1.46	7.76	6.06	2.30	13.98	13.48	12.92	57.96

Fixed Costs

	Depreciation	Interest on Investment	License	Insurance	Fixed Costs	Total Grain Transportation Costs
Dollars	242.81	273.33	12.13	43.68	571.94	1360.62
Per cent	17.85	20.09	0.89	3.21	42.04	100.00

Average costs for each unit for the southeastern district (No.3) are presented in Table 35. Costs were divided into average variable costs and average fixed costs. The average cost per tonne was calculated to be 383 cents, of which 222 cents were for the variable portion of costs and 161 cents for the fixed costs. The average cost per tonne-kilometre of transporting grain was calculated to be 16.59 cents. On a grain-kilometre basis, the average cost of transporting an average load of grain one kilometre was 85.85 cents. The average variable cost per grain-kilometre was 49.76 cents and the average fixed cost per grain-kilometre was 36.09 cents.

Table 35 also shows average unit cost per bushel, per bushel-mile, and per grain-mile in brackets.

Cost of Transporting Grain and Its Relationship With Size and Age of Truck

Size of Truck:

As size of truck was different in the district under study, a cost analysis by size of truck was considered essential. The size of farm truck was measured in (i) gross vehicle weight (kg), and (ii) capacity of grain box in tonnes.

The relationship between size of truck measured by gross vehicle weight (GVW) and average cost per tonne was not clear-cut. (Table 36). Average cost per tonne ranged from 336 cents for trucks in 12,001-14,000 kgs, category, to 242 cents for trucks in 10,001-12,000 kg, group.

As expected average cost per tonne-kilometre showed a negative relationship with size of farm truck measured by GVW. The only exception to the above relationship was for trucks in the 12,001-14,000 kg, class which showed a slightly higher unit cost over the preceding group. The negative relationship indicated that the average cost per tonne-kilometre decreased with the increase in size of farm trucks.

Total grain transportation costs, fixed costs as per cent of total costs, and total tonnes transported exhibited a positive relationship with size of truck measured by gross vehicle weight.

TABLE 35

UNIT COSTS OF TRANSPORTING GRAIN BY FARM TRUCK IN

IN SOUTHEASTERN DISTRICT - NO.3, ALBERTA

Units	Average Variable Cost	Average Fixed Cost	Average Cost
	Cents	Cents	Cents
Tonne*	222	161	383
(Bushel)	(5.28)	(3.83)	(9.11)
Tonne-Kilometre**	9.62	6.97	16.59
(Bushel-Mile)	(0.37)	(0.27)	(0.64)
Grain-Kilometre	49.76	36.09	85.85
(Grain-Mile)	(80.06)	(58.07)	(138.13)

* 1 tonne = 42 bushels
** 1 kilometre = 0.6216 miles

TABLE 36

RELATIONSHIP BETWEEN SIZE OF TRUCK (MEASURED BY GROSS VEHICLE WEIGHT) AND GRAIN TRANSPORTATION COSTS, SOUTHEASTERN DISTRICT - NO.3, ALBERTA

	Gross Vehicle Weight in Kilograms				
	0- 10 000	10 001- 12 000	12 001- 14 000	over 14 000	All Trucks
Average Size of Truck (Kg)	7 907	11 046	12 657	23 111	32 567
Number in Sample	18	9	32	27	86
Average Cost/Tonne (cents)	408	424	336	406	383
Average Cost/Tonne-Kilometre (cents)	29.62	20.32	22.57	12.92	16.59
Average Cost/Grain-Kilometre (cents)	97.69	73.65	86.80	85.33	85.85
Average Total Grain Transportatin Costs ($)	698.10	1049.20	1123.31	2187.37	1360.62
Fixed Cost as a Per cent of Total Grain Transportation Costs	37.74	39.07	39.30	45.09	42.04
Average Total Tonnes Transported	171.1	247.5	334.6	539.4	355.5
Average Total Tonne-Kilometres	2 357	5 162	4 977	16 931	8 201
Average Total Grain-Kilometres	715	1 424	1 294	2 563	1 585

The relationship between average cost per tonne-kilometre and the capacity of grain box in tonnes was negative (Table 37). Average unit costs ranged from 41.49 cents for trucks in the up to 7 tonnes box capacity group to 11.39 cents for trucks in the over 9.5 tonnes category. The hypothesis that the average cost per tonne-kilometre would decrease with the increase in capacity of the grain box in tonnes held true. The relationship between other unit costs, i.e., per tonne and per grain-kilometre and size of truck measured by capacity of grain box was discernable.

Average total grain transportation costs, and other measures of truck utilization (tonnes transported and tonne-kilometres) showed a positive relationship with size of truck as measured by the capacity of grain box in tonnes.

Age of Truck:

The relationship between age of truck and average unit cost per tonne, per tonne-kilometre, and per grain-kilometre was not clear-cut (Table 38). Average cost per tonne ranged from 272 cents for trucks in the 1965-69 group to 550 cents for newer trucks in the 1980-84 class.

The average cost per tonne-kilometre was the lowest (14.22 cents) for trucks in the 1980-84 group, which could result in a higher utilization level in terms of distance travelled for transporting grain.

Average total grain transportation costs and fixed costs as per cent of total costs exhibited positive relationship with the age of truck. This relationship indicated that newer trucks had higher total costs because of high depreciation and interest costs.

Utilization levels in terms of tonnes transported, tonne-kilometres, and grain-kilometres showed an upward trend with the exception of one or two categories as shown in Table 38.

Relationship Between One-Way Distance to Elevator and Grain Transportation Costs

Average costs per tonne and one-way distance to the elevator did not show any significant relationship, as unit costs varied considerably from

TABLE 37

RELATIONSHIP BETWEEN SIZE OF TRUCK (MEASURED BY CAPACITY OF GRAIN BOX IN TONNES) AND GRAIN TRANSPORTATION COSTS, SOUTHEASTERN DISTRICT - NO.3, ALBERTA

	Capacity of Grain Box in Tonnes			
	0-7.0	7.1-9.5	Over 9.5	All Trucks
Average Capacity of Grain Box (t)	4.9	7.9	14.2	419
Number in Sample	22	41	23	86
Average Cost/Tonne (cents)	732	341	363	383
Average Cost/Tonne-Kilometre (cents)	41.49	21.26	11.39	16.59
Average Cost/Grain-Kilometre (cents)	105.26	81.36	84.82	85.85
Average Total Grain Transportion Costs ($)	830.23	1230.89	2099.22	1360.62
Fixed Cost as a Per cent of Total Grain Transportation Costs	41.36	39.98	45.48	42.04
Average Total Tonnes Transported	113.4	360.8	577.9	355.5
Average Total Tonne-Kilometres	2 001	5 791	18 428	8 201
Average Total Grain-Kilometres	789	1 513	2 475	1 585

TABLE 38

RELATIONSHIP BETWEEN AGE OF TRUCK AND GRAIN TRANSPORTATION COSTS,

SOUTHEASTERN DISTRICT - NO.3, ALBERTA

	Year of Truck					
	1964 And Older	1965-1969	1970-1974	1975-1979	1980-1984	All Trucks
Average Year of Truck	1959	1968	1973	1976	1981	1972
Number in Sample	14	10	19	29	14	86
Average Cost/Tonne (cents)	411	272	307	326	550	383
Average Cost/Tonne-Kilometre (cents)	20.77	16.04	16.62	21.66	14.22	16.59
Average Cost/Grain-Kilometre (cents)	65.86	67.99	86.62	94.32	88.49	85.85
Average Total Grain Transportation Costs ($)	498.81	788.48	1411.12	980.02	3350.96	1360.62
Fixed Cost as Per cent of Total Grain Transportation Costs	21.40	27.18	30.56	42.38	53.96	42.04
Average Total Tonnes Transported	121.4	290.0	458.9	301.0	609.2	355.5
Average Total Tonne-Kilometres	2401.4	4915.6	8 490	4 525	23 572	8 201
Average Total Grain-Kilometres	757	1 160	1 629	1 039	3 787	1 585
Average Annual Truck-Kilometres	2 551	5 181	5 945	5 389	11 309	5 989

one group to another (Table 39). However, average costs per tonne were the lowest (241 cents) for trucks with up to 11 kilometres one-way distance to elevator, and the highest (633 cents) for trucks transporting grain over 23 kilometres. It was expected that unit costs per tonne would show a marginal increase for trucks travelling longer distances compared to those travelling shorter distances. The above wide margin between cost per tonne for the two groups could be attributed to the different utilization levels of trucks in terms of tonnes of grain transported, and the proportion of fixed and variable costs.

The average cost per tonne-kilometre showed a negative relationship with the one-way distance to the elevator (Table 39). The only exception to the above relationship was the unit cost of 11.17 per tonne-kilometres for trucks in the 15.1-19 kilometres group. Unit costs for other groups ranged from 15.86 cents for trucks in over 23 kilometres group to 25.74 cents for trucks in the up to 11 kilometres group. The hypothesis that average costs per tonne-kilometre would decrease with the increase in one-way distance to the elevator holds true.

The relationship between average total grain transportation costs and other measures of truck utilization and the one-way distance to the primary elevator is presented in Table 39.

Relationship Between Size of Farm, Annual Truck Kilometres, Tonne Transported, Tonne-Kilometres, and Grain Transportation Costs

Size of Farm:

A less direct measure of truck utilization might be the size of farm in acres (Table 40). Farm truck utilization in terms of tonnes of grain transported and total tonne-kilometres service provided supported the expectation that trucks would be utilized more on larger farms than on smaller farms, although in some cases farm truck utilization levels were not significantly different.

The average cost per tonne ranged from 270 cents for trucks on farms in the 128-1,600 acres group to 503 cents for trucks in the 901-1,280

TABLE 39

RELATIONSHIP BETWEEN ONE-WAY DISTANCE TO ELEVATOR AND GRAIN TRANSPORTATION COSTS, SOUTHEASTERN DISTRICT - NO.3, ALBERTA

	One-Way Distance to Elevator in Kilometres					
	0.0-11.0	11.1-15.0	15.1-19.0	19.1-23.0	Over 23.0	All Trucks
Average One-Way Distance to Elevator (kilometres)	7.2	12.5	16.5	19.9	36.7	17.0
Number in Sample	32	13	15	8	18	86
Average Cost/Tonne (cents)	241	316	388	366	633	383
Average Cost/Tonne-Kilometre (cents)	25.74	23.03	11.17	18.18	15.86	16.59
Average Cost/Grain-Kilometre (cents)	102.21	99.67	80.21	79.57	79.21	85.85
Average Total Grain Transportation Costs ($)	784 18	1148.93	1604.70	954.09	2515.58	1360.62
Fixed Cost as a Per cent of Total Grain Transprotation Costs	38.76	44.96	45.90	38.68	41.40	42.04
Average Total Tonnes Transported	324.9	364.0	413.6	260.4	397.7	355.5
Average Total Tonne-Kilometres	3 046	4 989	14 360	5 248	15 866	8 201
Average Total Grain-Kilometres	767	1 153	2 001	1 199	3 176	1 585
Average Annual Truck Kilometres	3 561	4 394	7 809	5 129	10 324	5 989

TABLE 40

RELATIONSHIP BETWEEN SIZE OF FARM IN ACRES AND GRAIN TRANSPORTATION COSTS, SOUTHEASTERN DISTRICT - NO.3, ALBERTA

	Size of Farm in Acres					
	0-640	641-900	901-1280	1281-1600	Over 1600	All Trucks
Average Size of Farm in Acres	433	810	1 148	1 537	4 051	2 659
Number in Sample (grain trucks)	9	9	7	15	46	86
Average Cost/Tonne (cents)	424	352	503	270	398	383
Average Cost/Tonne-Kilometre (cents)	27.10	23.64	26.20	21.12	14.29	16.59
Average Cost/Grain-Kilometre (cents)	108.65	86.32	93.09	104.89	80.62	85.85
Average Total Grain Transportation Costs ($)	943.28	982.08	1419.53	870.37	1667.24	1360.62
Fixed Cost as a Per cent of Total Grain Transportation Costs	45.05	39.48	49.32	40.44	41.32	42.04
Average One-Way Distance to Elevator (kilometres)	19.8	15.6	14.7	11.6	18.8	17.0
Average Total Tonnes Transported	222.5	279.4	282.1	322.0	418.6	355.5
Average Total Tonne-Kilometres	3 480	4 154	5 419	4 122	11 670	8 201
Grain Kilometres as a Per cent of Annual Truck Kilometres	18.39	26.52	46.31	23.95	26.50	26.46
Average Annual Truck Kilometres	4 720	4 291	3 293	3 464	7 804	5 989

acres group (Table 40). Average cost per tonne-kilometre showed a negative relationship with size of farm, with the exception for trucks in the 901-1,280 acre category. It ranged from 14.29 cents for trucks on larger farms (over 1,600 acres) to 27.10 cents for trucks in the up to 640 acres group.

No discernable relationship existed between size of farm and total tonne-kilometres and annual truck kilometres.

Annual Truck Kilometres:

Annual truck kilometres (mileage) was another measure of level of utilization of farm trucks used for transporting grain to primary outlets. The relationship between annual truck kilometres and average cost per tonne-kilometre was a negative, with the exception of trucks in the 4,828-7,240 kilometre category (Table 41). Average unit costs ranged from 11.29 cents for trucks travelling over 9,654 kilometres annually to 43.10 cents for trucks travelling up to 1,609 kilometres annually. The expectation that average costs per tonne-kilometre would decrease with the increase in annual truck kilometres was substantiated by five of the six observations (Table 41).

A positive relationship existed between annual truck kilometres, total tonnes transported and total tonne-kilometres of service provided.

Tonnes Transported:

One of the direct measures of truck utilization is the volume of grain transported. When the average cost per tonne and per tonne-kilometre was examined with tonnes of grain transported in the south-eastern district (No.3), the relationship was negative as shown in Table 42. Average cost per tonne ranged from 300 cents for trucks in the over 571 tonne category to 694 cents for trucks in up to 95 tonnes group. Farm trucks in the 286.1-381 tonnes classification showed a slightly higher cost per tonne (496 cents) than the preceding group. Six out of seven observations indicated that the average cost per tonne decreased with the increase in tonnes of grain transported to various market outlets.

TABLE 41

RELATIONSHIP BETWEEN ANNUAL TRUCK KILOMETRES AND GRAIN TRANSPORTATION COSTS, SOUTHEASTERN DISTRICT - NO.3, ALBERTA

	Annual Truck Kilometres						
	0-1609	1610-3218	3219-4827	4828-7240	7241-9654	Over 9654	All Trucks
Average Annual Truck Kilometres	1 162	2 961	4 620	6 211	8 338	16 952	5 989
Number of Sample	18	25	13	5	11	14	86
Average Cost/Tonne (cents)	544	348	260	458	289	474	383
Average Cost/Tonne-Kilometre (cents)	43.10	28.77	20.80	23.66	15.80	11.29	16.59
Average Cost/Grain-Kilometre (cents)	161.60	118.58	85.64	82.94	69.32	73.63	85.85
Average Total Grain Transportation Costs ($)	580.13	979.47	906.05	1826.44	1472.31	3212.72	1360.62
Fixed Cost as Per cent of Total Grain Transportation Costs	45.69	45.38	36.44	45.08	30.93	44.21	42.04
Average Total Tonnes Transported	106.6	281.4	349.0	399.0	510.0	677.3	355.5
Average Total Tonne-Kilometres	1 346	3 404	4 355	7 721	9 318	28 446	8 201
Grain-Kilometres as Per cent of Annual Truck Kilometres	30.89	27.89	22.89	35.45	25.47	25.74	26.46

TABLE 42

RELATIONSHIP BETWEEN TOTAL TONNES TRANSPORTED AND GRAIN TRANSPORTATION COSTS, SOUTHEASTERN DISTRICT - NO.3, ALBERTA

	Tonnes Transported							
	0-95.0	95.1-190.0	190.1-286.0	286.1-381.0	381.1-476.0	476.1 571.0	Over 571.0	All Trucks
Average Total Tonnes Transported	54.2	140.9	245.5	332.5	416.9	510.4	872.3	355.5
Number in Sample	19	15	10	11	7	7	17	86
Average Cost/Tonne (cents)	694	638	475	496	375	313	300	383
Average Cost/Tonne-Kilometre (cents)	53.28	31.09	23.87	21.85	18.61	18.51	11.19	16.59
Average Cost/Grain-Kilometre (cents)	141.91	97.93	111.41	92.50	69.60	81.22	76.73	85.85
Average Total Grain Transportation Costs ($)	376.63	898.82	1166.56	1649.40	1562.28	1596.27	2615.08	1360.62
Fixed Cost as Per cent of Total Grain Transportation Costs	38.58	35.60	51.46	48.61	33.77	42.44	41.32	42.04
Average Total Tonne-Kilometres	707	2 891	4 886	7 550	8 396	8 622	23 380	8 201
Average Total Grain-Kilometres	265	918	1 047	1 783	2 245	1 965	3 408	1 585
Average Annual Truck Kilometres	1 643	5 009	6 054	4 681	7 585	5 839	11 925	5 989

At the beginning of the study a hypothesis was formulated that the average cost per tonne-kilometre would decrease as utilization of the truck as measured by total tonnes transported increases. This hypothesis was supported by the average costs per tonne-kilometre for the various classes of trucks, classified by tonnes transported. Average cost per tonne-kilometre ranged from 11.19 cents for trucks in the over 571 tonnes of grain transported group to 53.28 cents for trucks in the up to 95 tonnes group.

Although the average cost per grain-kilometre, did not show any consistent relationship with total tonnes transported, it exhibited a downward trend as volume of grain transported increased. It ranged from 76.73 cents for trucks in the over 571 tonnes group to 141.91 cents for trucks in the up to 95 tonnes group (Table 42).

Average grain transportation costs and other measures of truck utilization (tonne-kilometres, grain kilometres and annual truck kilometres) showed upward trends as tonnes transported increased.

Tonne-Kilometres:

The relationship between total tonne-kilometres (a measure of utilization of farm trucks) and average cost per tonne-kilometre was clearly negative (Table 43). The average cost per tonne-kilometre ranged from 12.35 cents for trucks in the over 7,662 tonne-kilometre group to 63.43 cents for trucks providing up to 766 tonne-kilometres service. The hypothesis that average cost per tonne-kilometre would decrease with the increase in tonne-kilometres was supported by all observations.

The relationship between average cost per tonne and tonne-kilometres was inconclusive, primarily because of varied utilization levels of farm trucks in the southeastern district (No.3).

The average cost per grain-kilometre also showed a negative relationship with total tonne-kilometres. Average cost per grain-kilometre was the highest (145.87 cents) for trucks providing up to 766 tonne-kilometres service, and lowest (74.05 cents) for the group of trucks providing over 7 662 tonne-kilometres service. The average cost per tonne-kilometre for the sample in the southeastern district was 85.85 cents.

TABLE 43

RELATIONSHIP BETWEEN TOTAL TONNE-KILOMETRES AND GRAIN TRANSPORTATION COSTS, SOUTHEASTERN - NO.3, ALBERTA

	Tonne-Kilometres						
	0-766.0	766.1-1532.0	1532.1-3065.0	3065.1-5746.0	5746.1-7662.0	Over 7662.0	All Trucks
Average Total Tonne-Kilometres	429	1 079	2 214	4 337	6 417	23 495	8 201
Number in Sample	10	12	14	19	9	22	86
Average Cost/Tonne (cents)	595	655	319	292	364	422	383
Average Cost/Tonne-Kilometre (cents)	63.43	50.19	31.42	27.84	19.49	12.35	16.59
Average Cost/Grain-Kilometre (cents)	145.87	141.31	118.97	109.79	77.47	74.05	85.85
Average Total Grain Transportation Costs ($)	272.26	514.53	695.70	1207.36	1250.64	2902.6	1360.62
Fixed Cost as Per cent of Total Grain Transportation Costs	39.56	37.97	40.08	43.02	36.23	43.52	42.04
Average Total Tonnes Transported	45.7	82.6	218.2	413.7	343.3	687.4	355.5
Average Total Grain-Kilometres	187	383	585	1 100	1 614	3 920	1 585
Average One-Way Distance to Elevator (kilometres)	11.6	15.6	12.5	11.4	22.3	25.7	17.0

Total grain transportation costs, total tonnes transported and average total grain-kilometres showed a positive relationship with tonne-kilometres service.

The average one-way distance to primary elevators for the study sample in district No.3 was 17 kilometres.

SECTION VIII

AVERAGE TOTAL COSTS OF TRANSPORTING GRAIN BY FARM TRUCK IN EASTCENTRAL DISTRICT - NO.4

Total Costs of Grain Transportation

All of the cost components presented in Table 44, except for driving and dead-haul labor, have been weighted by grain-kilometres as a proportion of total annual truck kilometres. Thus, the costs shown in Table 44, except driving and dead-haul labor, are not the total annual costs for a truck, rather, these are the portions of all costs attributable to the transportation of grain from farm to primary elevators and other sales outlets.[7]

The total grain transportation cost per farm truck in the eastcentral district was calculated from data on 59 farm trucks used for transporting grain to primary elevators and other sales outlets. The total grain transportation cost for this district was $1,620.22 per farm truck during the 1983-84 crop year. The average fixed costs per farm truck amounted to $686.50 or 42.37 per cent of the total grain transportation costs.

The largest component of grain transportation costs was interest on the investment which accounted for 20.13 per cent of the total costs. It was followed by depreciation (17.57 per cent), fuel (15.81 per cent) and driving labor (14.96 per cent). Dead-haul labor (loading, unloading and waiting, etc.) accounted for 13.22 per cent of the total costs (Table 44).

The (59) farm trucks reported in the eastcentral district carried 25,825 tonnes of grain to primary elevators and other sales outlets. In terms of tonne-kilometres, the trucks in the sample provided 618,615

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7 Other sales outlets include seed plants, feed mills, crushing plants, feedlots, and deliveries to other farmers.

TABLE 44

AVERAGE TOTAL COSTS OF TRANSPORTING GRAIN PER FARM TRUCK

IN EASTCENTRAL DISTRICT - NO.4, ALBERTA

Variable Costs

	Lubric	Parts	Tires and Batteries	Maintenance and Repair Labor	Fuel	Driving Labor	Dead-Haul Labor	Total Variable Costs
Dollars	19.61	96.76	69.84	34.81	256.19	242.35	214.16	933.72
Per cent	1.21	5.97	4.31	2.15	15.81	14.96	13.22	57.63

Fixed Costs

	Depreciation	Interest on Investment	License	Insurance	Fixed Costs	Total Grain Transportation Costs
Dollars	284.72	326.11	15.70	59.97	686.50	1620.22
Per cent	17.57	20.13	0.97	3.70	42.37	100.00

tonne-kilometres of service in transporting grain from farms to primary elevators and other sales outlets.

Unit Costs of Transporting Grain by Farm Truck

Unit costs were calculated to represent costs per tonne, per tonne-kilometre, and per grain-kilometre. The average cost for each unit was divided into the variable costs and fixed costs. The average unit costs for the eastcentral district are presented in Table 45.

The average cost per tonne was calculated to be 370 cents in the eastcentral district during the 1983-84 crop year. The average variable cost amounted to 213 cents per tonne whereas the average fixed cost was 157 cents per tonne. The average cost per tonne-kilometre was 15.45 cents, of which 8.90 cents was the variable cost portion and the balance was the fixed cost.

On a grain-kilometre basis, the average cost of transporting an average load of grain one kilometre was 76.16 cents. The average variable cost per grain-kilometre was 43.89 cents and the average fixed cost per grain-kilometre was 32.27 cents.

Cost of Transporting Grain and Its Relationship With Size and Age of Truck

Size of Truck:

The size of truck was measured in (i) gross vehicle weight (kg) and (ii) capacity of grain box in tonnes.

The relationship between size of truck measured by gross vehicle weight (GVW) and average cost per tonne was negative with an exception for trucks in the 10,001 to 12,000 kg category, (GVW) group. The average cost per tonne ranged from 362 cents for the heavier trucks (over 14,000 kg), to 425 cents for trucks GVW of up to 10,000 kg, (Table 46).

The average cost per tonne-kilometre also exhibited a negative relationship, with the exception of trucks in the 12,000-14,000 kg. GVW group. It ranged from 10.25 cents for trucks over 14,000 kg, GVW to 65.72 cents for trucks in the up to 10,000 kg, GVW group.

TABLE 45

UNIT COSTS OF TRANSPORTING GRAIN BY FARM TRUCK IN

EASTCENTRAL DISTRICT - NO.4, Alberta

Units	Average Variable Cost	Average Fixed Cost	Average Cost
	Cents	Cents	Cents
Tonne*	213	157	370
(Bushel)	(5.07)	(3.74)	(8.81)
Tonne-Kilometre**	8.90	6.55	15.45
(Bushel-Mile)	(0.34)	(0.25)	(0.59)
Grain-Kilometre	43.89	32.27	76.16
(Grain-Mile)	(70.62)	(51.92)	(122.54)

* 1 tonne = 42 bushels
** 1 kilometre = 0.6216 miles

TABLE 46

RELATIONSHIP BETWEEN SIZE OF TRUCK (MEASURED BY GROSS VEHICLE WEIGHT) AND GRAIN TRANSPORTATION COSTS, EASTCENTRAL DISTRICT - NO.4, ALBERTA

	Gross Vehicle Weight in Kilograms				
	0-10,000	10,001-12,000	12,001-14,000	Over 14,000	All Trucks
Average Size of Truck (Kg)	8 797	10 865	13 029	21 419	13 540
Number in Sample	10	13	24	12	59
Average Cost/Tonne (cents)	425	343	373	362	370
Average Cost/Tonne-Kilometre (cents)	19.38	17.71	20.06	10.25	15.45
Average Cost/Grain-Kilometre (cents)	65.72	64.41	85.37	75.14	76.16
Average Total Grain Transportation Costs ($)	1094.83	1073.62	1800.56	2289.50	1620.22
Fixed Cost as Per cent of Total Grain Transportation Costs	27.22	37.78	42.80	49.87	43.37
Average Total Tonnes Transported	257.7	313.2	482.7	632.6	437.7
Average Total Tonne-Kilometres	5 648	6 062	8 974	22 332	10 485
Average Total Grain-Kilometres	1 666	1 667	2 109	3 047	2 127

The average total grain transportation costs increased with the increase in size of farm trucks measured by GVW. The fixed cost as a per cent total grain transportation costs also increased with the increase in size of truck. Other measures of truck utilization (total tonnes transported, total tonne-kilometres, and total grain-kilometres) showed upward trends as size of trucks (GVW) increased.

When size of truck was measured by the capacity of the grain box in tonnes, the average cost per tonne and per tonne-kilometre exhibited a negative relationship. In other words, both unit costs (per tonne, per tonne-kilometre) decreased with the increase in size of truck measured by capacity of grain box in tonnes (Table 47). The decrease in both unit costs was by no means uniform, because of different levels of truck utilization.

The average cost per grain-kilometre showed a positive relationship, opposite to the relationships shown by the other two other unit costs. A positive relationship indicates that the average cost per grain-kilometre increased with the increase in capacity of grain box in tonnes.

As expected, the total grain transportation costs, total tonnes transported, total tonne-kilometres, and total grain-kilometres showed upward trends with the increase in capacity of grain box in tonnes.

Fixed costs as per cent of total grain transportation costs also showed an upward trend as the capacity of grain trucks in tonnes increased because heavier trucks have relatively higher depreciation and interest costs.

Age of Truck:

The relationship between average unit cost (per tonne, per tonne-kilometre and per grain-kilometre) and the age of trucks was not clear-cut (Table 48). However, older trucks did show lower costs per tonne and per grain-kilometre at 276 cents and 62.33 cents, respectively. Average cost per tonne-kilometre ranged from 13.54 cents for trucks in 1975-79 age group to 21.26 cents for trucks in the 1980-84 age category.

RELATIONSHIP BETWEEN SIZE OF TRUCK (MEASURED BY CAPACITY OF GRAIN BOX IN TONNES) AND GRAIN TRANSPORTATION COSTS, EASTCENTRAL DISTRICT - NO.4, ALBERTA

	Capacity of Grain Box in Tonnes			
	0-7.0	7.1-9.5	Over 9.5	All Trucks
Average Capacity of Grain Box (t)	5.6	8.2	13.4	8.9
Number in Sample	12	33	14	59
Average Cost/Tonne (cents)	432	365	363	370
Average Cost/Tonne-Kilometre (cents)	24.13	18.61	10.87	15.45
Average Cost/Grain-Kilometre (cents)	70.80	76.05	78.37	76.16
Average Total Grain Transportation Costs ($)	867.80	1647.53	2200.77	1620.22
Fixed Cost as Per cent of Total Grain Transportation Costs	31.38	41.15	48.23	42.37
Average Total Tonnes Transported	200.9	451.9	607.1	437.7
Average Total Tonne-Kilometres	3 596	8 853	20 239	10 485
Average Total Grain-Kilometres	1 226	2 166	2 808	2 127

TOTAL 48

RELATIONSHIP BETWEEN AGE OF TRUCK AND GRAIN TRANSPORTATION COSTS,

EASTCENTRAL DISTRICT - NO.4, ALBERTA

	Year of Truck					
	1964 And Older	1965-1969	1970-1974	1975-1979	1980-1984	All Trucks
Average Year of Truck	1962	1967	1972	1976	1982	1974
Number in Sample	4	9	10	27	9	59
Average Cost/Tonne (cents)	276	359	422	362	382	370
Average Cost/Tonne-Kilometre (cents)	15.17	18.97	14.46	13.54	21.26	15.45
Average Cost/Grain-Kilometre (cents)	62.33	63.61	63.04	76.24	95.10	76.16
Average Total Grain Transportation Costs ($)	805.33	710.05	1387.71	1774.94	2686.74	1620.22
Fixed Cost as Per cent of Total Grain Transportation Costs	24.13	28.11	37.32	42.19	51.83	42.37
Average Total Tonnes Transported	292.1	197.5	328.8	490.8	704.2	437.7
Average Total Tonne-Kilometres	5 310	3 744	9 599	13 112	12 635	10 485
Averge Total Grain-Kilometres	1 292	1 116	2 201	2 328	2 825	2 127
Average Annual Truck Kilometres	3 540	3 504	5 792	7 544	7 866	6 409

Over 60 per cent of the farm trucks in the eastcentral district were purchased between 1970-79, with about 45 per cent bought in 1975-79. Farm trucks in the 1964 and older category had significantly higher utilization levels compared to trucks in the following group, i.e., 1965-69. With the exception of trucks in the 1965-1969 group, average grain transportation costs and other measures showed a upward trend in relationship to age of trucks. Fixed costs as per cent of total grain transportation costs showed a positive relationship with age of truck which could be attributed to higher depreciation and interest costs on investment.

Relationship Between One-Way Distance to Elevator and Grain Transportation Costs

The relationship between the one-way distance to the elevator and average cost per tonne was not consistent (Table 49). The average cost per tonne ranged form 232 cents for trucks in 11.1-15 kilometres group to 481 cents for trucks in the 19.1 to 23 kilometres group. The average cost per tonne-kilometres showed a negative relationship with the one-way distance to the elevator, with the exception of trucks in the 0-11 kilometres group which had lowest unit cost compared to the other group. The hypothesis that the average cost per tonne-kilometre would decrease as the one-way distance to the elevator increases was supported in four observations out of five.

The average cost per grain-kilometre ranged from 62.23 cents for trucks in the over 23 kilometres group to 96.97 cents for trucks in the 11.1-15 kilometres group. It did not show any consistent relationship with one-way distance to elevator, although it was anticipated that the average cost per grain-kilometre would decrease with the increase in distance to the elevator.

Utilization levels for various groups of trucks showed considerable variation in terms of tonnes of grain transported, tonne-kilometres and grain-kilometres. Average annual truck kilometres travelled also varied considerably.

RELATIONSHIP BETWEEN ONE-WAY DISTANCE TO ELEVATOR AND GRAIN TRANSPORTATION COSTS,

EASTCENTRAL DISTRICT - NO.4, ALBERTA

	One-Way Distance to Elevator in Kilometres					
	0-11.0	11.1-15.0	15.1-19.0	19.1-23.0	Over 23.1	All Trucks
Average One-Way Distance to Elevator (kilometres)	6.0	12.9	16.4	20.4	29.6	16.1
Number in Sample	17	15	9	3	15	59
Average Cost/Tonne (cents)	352	323	371	481	436	370
Average Cost/Tonne-Kilometre (cents)	12.07	22.46	20.92	19.22	13.44	15.45
Average Cost/Grain-Kilometre (cents)	75.41	96.97	80.02	74.95	62.23	76.16
Average Total Grain Transportation Costs ($)	1718.95	1644.77	1279.81	1925.47	1626.96	1620.22
Fixed Cost as a Per cent of Total Grain Transportation Costs	41.75	47.13	45.48	29.56	39.87	42.37
Average Total Tonnes Transported	487.9	508.8	344.7	400.4	372.9	437.7
Average Total Tonne-Kilometres	14 243	7 323	6 118	10 017	12 104	10 485
Average Total Grain-Kilometres	2 279	1 696	1 599	2 569	2 615	2 127
Average Annual Truck Kilometres	7 666	5 556	4 326	5 363	7 294	6 409

Relationship Between Size of Farm, Annual Truck Kilometres, Tonne Transported, Tonne-Kilometres and Grain Transportation Costs

Size of Farm:

Size of farm is a somewhat less direct measure of truck utilization. The relationship between size of farm and unit costs was analyzed to observe utilization levels of farm trucks on different farms. The average cost per tonne did not show any consistent relationship with size of farm as it ranged from 306 cents for trucks on 961-1,280 acre farms to 459 cents for trucks on the up to 640 acre farms, (Table 50). The average cost per tonne-kilometre exhibited a negative relationship with size of farm, with the exception of trucks on 1,281-1,600 acre farms. The negative relationship indicated that the average cost per tonne-kilometre decreased as size of farm increased. In other words, as expected, trucks on larger farms have a higher utilization level resulting in lower unit costs per tonne-kilometre.

Total grain transportation costs, total tonnes of grain transported, and the total tonne-kilometres showed upward trends with the increase in size of farm. The only exception to the above trend was for trucks in the 1,281-1,600 acre farm size group, which showed relatively lower grain transportation costs vis-a-vis low utilization levels.

Annual Truck Kilometres:

When utilization of farm trucks was measured by annual truck kilometres, a negative relationship was found between average cost per tonne-kilometre and annual truck kilometres (Table 51). The average cost per tonne-kilometre ranged from 47.30 cents for trucks in the up to 1,609 annual kilometres group to 7.58 cents for trucks in over 9,654 annual kilometres category. The inverse relationship was supported by the observations in Table 51.

TABLE 50

RELATIONSHIP BETWEEN SIZE OF FARM IN ACRES AND GRAIN TRANSPORTATION COSTS, EASTCENTRAL DISTRICT - NO.4, ALBERTA

	Size of Farm in Acres					
	0-640	641-960	961-1280	1281-1600	Over 1600	All Trucks
Average Size of Farm In Acres	512	831	1 112	1 488	3 619	1 958
Number in Sample (grain trucks)	5	16	10	6	22	59
Average Cost/Tonne (cents)	459	396	306	398	374	370
Average Cost/Tonne-Kilometre (cents)	23.09	20.23	18.39	19.70	12.53	15.45
Average Cost/Grain-Kilometre (cents)	73.98	76.26	88.52	80.59	72.48	76.16
Average Total Grain Transportation Costs ($)	941.84	1505.70	1571.22	803.08	2102.81	1620.22
Fixed Cost as Per cent of Total Grain Transportation Costs	34.32	33.33	46.24	37.97	47.04	42.37
Average One-Way Distance to Elevator (kilometres)	20.3	16.0	16.6	18.5	14.3	16.1
Average Total Tonnes Transported	205.1	380.2	513.4	201.7	562.3	437.7
Average Total Tonne-Kilometres	4 080	7 442	8 543	4 077	16 786	10 485
Grain Kilometres as Per cent of Annual Truck Kilometres	27.28	29.48	33.84	25.99	37.07	33.19
Average Annual Truck Kilometres	4 666	6 697	5 245	3 835	7 826	6 409

TABLE 51

RELATIONSHIP BETWEEN ANNUAL TRUCK MILEAGE AND GRAIN TRANSPORTATION COSTS,

EASTCENTRAL DISTRICT - NO.4, ALBERTA

	Annaul Truck Kilometres						
	0- 1 609	1610- 3 218	3219- 4 827	4828- 7 240	7241- 9 654	Over 9 654	All Trucks
Average Annual Truck Mileage	1 368	3 101	4 371	6 248	8 281	17 377	6 409
Number in Sample	4	11	12	12	15	5	59
Average Cost/Tonne (cents)	477	446	384	326	367	379	370
Average Cost/Tonne-Kilometre (cents)	47.30	28.42	21.13	19.44	13.10	7.58	15.45
Average Cost/Grain-Kilometre (cents)	110.88	108.90	80.97	82.74	65.90	58.43	76.16
Average Total Grain Transportation Costs ($)	349.67	1232.61	1569.66	2063.19	1644.25	2475.49	1620.22
Fixed Cost as Per cent of Total Grain Transportation Costs	41.81	37.08	46.66	43.44	43.08	38.16	42.37
Average Total Tonnes Transported	73.2	276.2	409.2	632.7	448.3	652.8	437.7
Average Total Tonne-Kilometres	739	4 337	7 429	10 614	12 553	32 638	10 485
Grain Kilometres as Per cent of Annual Truck Kilometres	23.06	36.50	44.35	39.91	30.13	24.38	33.19

The average cost per tonne also exhibited a negative relationship with annual truck kilometres, with the exception to trucks in the last two categories of annual truck kilometres. Farm trucks in these two categories showed higher unit costs per tonne, which could be attributed to either higher total grain transportation costs or relatively lower utilization levels in terms of tonnes transported.

The relationship between average cost per grain-kilometre and annual truck kilometres was also negative, with the exception for trucks in the 3,219-4,827 annual kilometres group. Unit costs ranged from 58.43 cents per grain-kilometre for trucks with the highest annual distance travelled (over 9,654 kms) to 110.88 cents for trucks with the lowest annual distance travelled (up to 1,609).

The hypothesis that average unit costs would decrease with the increase in annual distance travelled was well supported by the data presented in Table 51.

Average total grain transportation costs and other measures of truck utilization indicate a positive relationship with annual truck kilometres.

Tonnes Transported:

The average cost per tonne was the highest (708 cents) for trucks transporting up to 95 tonnes of grain, and the lowest (315 cents) for those transporting over 571 tonnes of grain annually (Table 52). Unit costs for other groups were between the above ranges.

The average cost per tonne-kilometre ranged from 9.244 cents for trucks transporting 476.1-571 tonnes of grain to 31.24 cents for trucks transporting up to 95 tonnes of grain annually. It was expected that a negative relationship would exist between volume of grain transported and average unit costs. However, owing to significant variation in utilization levels of trucks in different groups, the relationship between average unit cost and tonnes of grain transported was not consistent.

Total grain transportation costs, total tonne-kilometres and grain-kilometres increased with the increase in tonnes of grain

TABLE 52

RELATIONSHIP BETWEEN TOTAL TONNES TRANSPORTED AND GRAIN TRANSPORTATION COSTS,

EASTCENTRAL DISTRICT - NO.4, ALBERTA

	Tonnes Transported							
	0-95.0	95.1-190.0	190.1-286.0	286.1-381.0	381.1-476.0	476.1-571.0	Over 571	All Trucks
Average Total Tonnes Transported	46.5	139.8	231	318	442.9	514.4	818.7	437.7
Number in Sample	4	6	12	10	3	7	17	59
Average Cost/Tonne (cents)	708	365	484	451	388	400	315	370
Average Cost/Tonne-Kilometre (cents)	31.24	23.55	17.07	21.31	17.62	9.24	16.23	15.45
Average Cost/Grain-Kilometre (cents)	91.75	93.72	70.68	84.32	70.33	57.49	83.71	76.16
Average Total Grain Transportation Costs ($)	329.21	510.70	1118.44	1433.99	1717.04	2056.32	2582.66	1620.22
Fixed Costs as Per cent of Total Grain Transportation Costs	37.18	39.89	34.86	36.40	35.51	36.14	49.79	42.37
Average Total Tonne-Kilometres	1 054	2 168	6 551	6 730	9 745	22 245	15 917	10 485
Average Total Grain-Kilometres	359	545	1 582	1 701	2 441	3 577	3 085	2 127
Average Annual Truck Kilometres	2 413	3 647	6 262	4 988	9 118	11 493	6 692	6 409

transported. The relationship between annual truck-kilometres and tonnes of grain transported was not clear-cut because of a considerable variation in the size of truck and distances to travel to deliver grain to primary outlets.

Tonne-Kilometres:

The relationship between total tonne-kilometres (a measure of utilization of farm trucks) and average cost per tonne was negative with a few exceptions (Table 53). The average cost per tonne ranged from 296 cents for trucks in the 3,065-5,746 tonne-kilometres group to 574 cents for trucks in the up to 766 tonne-kilometres category.

The relationship between average cost per tonne-kilometre and total tonne-kilometres was negative as hypothesized (Table 53). In other words, average unit costs decreased as total tonne-kilometres service provided by farm trucks increased. It ranged from 13.66 cents for trucks in the over 7,662 tonne-kilometre group. One exception to the above relationship was the unit cost per tonne-kilometre (26.63 cents) for trucks in the up to 766 tonne-kilometre group.

No discernable relationship was observed between average cost per grain-kilometre and average total tonne-kilometres.

Total grain transportation costs, total tonnes transported and grain-kilometres showed a positive relationship when examined with total tonne-kilometres of service.

TABLE 53

RELATIONSHIP BETWEEN TOTAL TONNE-KILOMETRES AND GRAIN TRANSPORTATION COSTS, EASTCENTRAL DISTRICT - NO.4, ALBERTA

	Total Tonne-Kilometres						
	0-766.0	766.1 - 1532.0	1532.1-3065.0	3065.1-5746.0	5746.1-7662.0	Over 766.2	All Trucks
Average Total Tonne-Kilometres	436	1 201	2 186	4 624	6 874	17 842	10 485
Number in Sample	2	3	6	16	4	28	59
Average Cost/Tonne (cents)	574	445	403	296	406	387	370
Average Cost/Tonne-Kilometre (cents)	26.63	44.84	28.88	21.94	19.97	13.66	15.45
Average Cost/Grain-Kilometre (cents)	87.90	106.37	94.25	90.11	68.54	72.83	76.16
Average Total Grain Transportation Costs ($)	115.98	583.57	631.35	1014.38	1372.98	2436.97	1620.22
Fixed Cost as Per cent of Total Grain Transportation Costs	37.62	42.06	33.01	35.34	38.41	44.91	42.37
Average Total Tonnes Transported	20.2	121.1	156.6	342.1	338.4	630.4	437.7
Average Total Grain-Kilometres	132	506	670	1 126	2 003	3 346	2 127
Average One-Way Distance to Elevator (kilometres)	23.3	9.1	17.4	13.2	18.9	17.2	16.1

SECTION IX

AVERAGE TOTAL COSTS OF TRANSPORTING GRAIN BY FARM TRUCK IN WESTCENTRAL DISTRICT - NO.5

Total Costs of Grain Transportation

The average total costs presented in Table 54 have been weighted by grain-kilometres as a proportion of total annual truck kilometres. Driving and dead-haul labor costs are actual costs calculated on the basis of information provided. The costs shown in Table 54 are not the total costs of operating a truck, rather, these are portions of all costs (except for driving and dead-haul labor costs) attributable to transportation of grain from farms to primary elevators and other sales outlets.

Total grain transportation cost per farm truck in the westcentral district was calculated to be $1,612.80 during the 1983-84 crop year. Total fixed cost per farm truck amounted to $650.05 or 40.31 per cent of total grain transportation costs.

As in other districts, the largest component of grain transportation costs was interest on investment, which accounted for 18.56 per cent ($299.30), followed by depreciation at 16.52 per cent ($266.40), fuel at 15.96 per cent ($257.36), dead-haul labor at 13.89 per cent ($244.14), and driving labor at 12.43 per cent ($200.46).

The (75) farm trucks used for hauling grain in the westcentral district carried 35,482 tonnes of grain to primary elevators and other sales outlets. In terms of tonne-kilometres, trucks in the sample provided 663,225 tonne-kilometres of service in transporting grain from farms to primary elevators and other sales outlets. The total distance travelled by these trucks to transport grain (one-way distance) was 135,000 kilometres or 1,800 kilometres per truck.

TABLE 54

AVERAGE TOTAL COSTS OF TRANSPORTING GRAIN PER FARM TRUCK

IN WESTCENTRAL DISTRICT - NO.5, ALBERTA

Variable Costs

	Lubric	Parts	Tires and Batteries	Maintenance and Repair Labor	Fuel	Driving Labor	Dead-Haul Labor	Total Variable Costs
Dollars	26.57	125.41	84.32	44.50	257.36	200.46	224.14	962.75
Per cent	1.65	7.77	5.23	2.76	15.96	12.43	13.89	59.69

Fixed Costs

	Depreciation	Interest on Investment	License	Insurance	Fixed Costs	Total Grain Transportation Costs
Dollars	266.40	299.30	14.79	69.56	650.05	1612.80
Per cent	16.52	18.56	0.92	4.31	40.31	100.00

Unit Costs of Transporting Grain by Farm Truck

Three types of average costs were calculated to present costs on a unit basis, the units being the tonne, tonne-kilometre, and grain-kilometre.

The average cost for each unit in the westcentral district is shown in Table 55. The average cost was divided into average variable costs and average fixed costs.

The average cost per tonne was calculated to be 341 cents, the average cost per tonne-kilometre was 18.24 cents, and per grain-kilometre it amounted to 89.62 cents.

The average cost per bushel, per bushel-mile and per grain-mile is presented in brackets.

Cost of Transporting Grain and Its Relationship With Size and Age of Truck

Size of Truck:

As the size of truck varied considerably in the district, a cost analysis by size of truck was considered essential. The size of truck was measured in (i) gross vehicle weight and (ii) capacity of grain box in tonnes.

The relationship between size of truck measured by gross vehicle weight (GVW) and average cost per tonne was expected to be negative (Table 56). However, it did not show any consistent relationship because of varied utilization among different trucks. The average cost per tonne ranged from 253 cents for trucks in 10,001-12,000 GVW group to 396 cents for trucks in the up to 10,000 kg, GVW category. The average cost per tonne-kilometre and gross vehicle weight in kilograms exhibited a somewhat negative relationship. The average cost per tonne-kilometre ranged from 16.12 cents for trucks in the over 14,000 kg, GVW group to 22.13 cents for trucks in 12,001-14,000 kg, GVW group. An exception to the above relationship was for trucks in 12,001-14,000 kg, GVW group

TABLE 55

UNIT COSTS OF TRANSPORTING GRAIN BY FARM TRUCK

IN WESTCENTRAL DISTRICT - NO.5, Alberta

Units	Average Variable Cost	Average Fixed Cost	Average Cost
	Cents	Cents	Cents
Tonne*	204	137	341
(Bushel)	(4.86)	(3.26)	(8.12)
Tonne-Kilometre**	10.89	7.35	18.24
(Bushel-Mile)	(0.42)	(0.28)	(0.70)
Grain-Kilometre	53.49	36.13	89.62
(Grain-Mile)	(86.06)	(58.13)	(144.19)

* 1 tonne = 42 bushels
** 1 kilometre = 0.6216 miles

TABLE 56

RELATIONSHIP BETWEEN SIZE OF TRUCK (MEASURED BY GROSS VEHICLE WEIGHT) AND GRAIN TRANSPORTATION COSTS, WESTCENTRAL DISTRICT - NO.5, ALBERTA

	Gross Vehicle Weight in Kilograms				
	0-10,000	10,001-12,000	12,001-14,000	Over 14,000	All Trucks
Average Size of Truck (Kg)	8 026	11 019	12 892	19 124	14 247
Number in Sample	11	7	30	27	75
Average Cost/Tonne (cents)	396	253	329	353	341
Average Cost/Tonne-Kilometre (cents)	20.32	17.38	22.13	16.12	18.24
Average Cost/Grain-Kilometre (cents)	65.76	73.60	98.13	92.27	89.62
Average Total Grain Transportation Costs ($)	1006.09	898.96	1386.27	2296.75	1612.80
Fixed Cost as Per cent of Total Grain Transportation Costs	33.72	29.15	42.00	41.48	40.31
Average Total Tonnes Transported	254.1	355.56	421.1	650.6	473.1
Average Total Tonne-Kilometres	4 951	5 173	6 263	14 248	8 843
Average Total Grain-Kilometres	1 530	1 221	1 413	2 489	1 800

which showed higher unit cost when compared to other groups. The hypothesis that average cost per tonne-kilometre would decrease with increase in gross vehicle weight was supported by three observations out of four.

Average total grain transportation costs, with the exception of trucks in the 10,001-12,000 kg, group, showed an upward trend. Other measures of truck utilization i.e., tonnes of grain transported, and total tonne-kilometres, showed a positive relationship with size of truck.

The relationship between average cost per tonne and capacity of grain box in tonnes (a measure of size of truck) was negative as shown in Table 57. The average cost per tonne ranged from 312 cents for trucks with box capacities over 9.5 tonnes to 395 cents for trucks with box capacities up to 7 tonnes. The negative relationship indicated that as size of capacity of box increased, average cost per tonne decreased.

The average cost per tonne-kilometre also exhibited a negative relationship with capacity of grain box in tonnes, with the exception of trucks in the 7.1 to 9.5 tonne (capacity of grain box) group. Farm trucks in this group showed slightly higher unit costs over the preceding group. Average costs per tonne-kilometre were 20.93 cents for trucks in the up to 7 tonne group, increased to 21.74 cents for trucks in the 7.1 to 9.5 tonne group, and decreased sharply to 14.49 cents for trucks with over 9.5 tonnes capacity.

The total tonnes transported and total tonne-kilometres showed a positive relationships with size of truck measured by capacity of grain box in tonnes. In other words, heavier trucks transported more grain over longer hauls than smaller trucks.

Age of Truck:

The relationship between average unit cost and age of truck appeared to be positive (Table 58). The average cost per tonne ranged from 271 cents for trucks in the 1965-69 age group to 424 cents for trucks in the 1980-84 category. Average cost per tonne-kilometre was 14.05 cents for trucks in the 1964 and older group and 20.70 cents per tonne-kilometre for trucks in the 1980-84 age group. Similarly, the average

TABLE 57

RELATIONSHIP BETWEEN SIZE OF TRUCK (MEASURED BY CAPACITY OF GRAIN BOX IN TONNES) AND GRAIN TRANSPORTATION COSTS, WESTCENTRAL DISTRICT - NO.5, ALBERTA

	Capacity of Grain Box in Tonnes			
	0-7.0	7.1-9.5	Over 9.5	All Trucks
Average Capacity of Grain Box (t)	5.1	8.7	12.6	9.5
Number in Sample	11	38	26	75
Average Cost/Tonne (cents)	395	359	312	341
Average Cost/Tonne-Kilometre (cents)	20.93	21.74	14.49	18.24
Average Cost/Grain-Kilometre (cents)	54.56	91.94	92.87	89.62
Average Total Grain Transportation Costs ($)	476.40	1833.34	1771.26	1612.80
Fixed Cost as Per cent of Total Grain Transportation Costs	29.57	43.31	36.98	40.31
Average Total Tonnes Transported	120.5	510.8	567.2	473.1
Average Total Tonne-Kilometres	2 276	8 431	12 224	8 843
Average Total Grain-Kilometres	873	1 994	1 907	1 800

TOTAL 58

RELATIONSHIP BETWEEN AGE OF TRUCK AND GRAIN TRANSPORTATION COSTS,

WESTCENTRAL DISTRICT - NO.5, ALBERTA

	Year of Truck					
	1964 And Older	1965-1969	1970-1974	1975-1979	1980-1984	All Trucks
Average Year of Truck	1962	1967	1973	1977	1981	1974
Number in Sample	7	12	17	28	11	75
Average Cost/Tonne (cents)	273	271	330	323	424	341
Average Cost/Tonne-Kilometre (cents)	14.05	17.03	16.61	18.77	20.70	18.24
Average Cost/Grain-Kilometre (cents)	65.46	69.94	93.49	88.91	98.39	89.62
Average Total Grain Transportation Costs ($)	539.86	814.92	2015.84	1393.11	3102.33	1612.80
Fixed Cost as Per cent of Total Grain Transportation Costs	24.19	23.93	33.69	37.31	56.85	40.31
Average Total Tonnes Transported	197.4	301.2	610.0	430.8	732.3	473.1
Average Total Tonne-Kilometres	3 843	4 784	12 136	7 421	14 984	8 843
Averge Total Grain-Kilometres	825	1 165	2 156	1 567	3 153	1 800
Average Annual Truck Kilometres	3 793	4 264	5 584	6 303	6 260	5 573

cost per grain-kilometre was lowest for older trucks and the highest for newer trucks.

Total grain transportation costs showed an upward trend with the exception of trucks in the 1975-79 age group. With the decrease in age of truck, the average cost per truck increased. Fixed costs as per cent of total grain transportation costs also showed an upward trend as age of the trucks decreased, i.e., newer trucks had higher fixed costs compared to older trucks. Newer trucks exhibited relatively higher levels of utilization in terms of tonnes transported and tonne-kilometres of service provided.

Relationship Between One-Way Distance to Elevator and Grain Transportation Costs

The relationship between average cost per tonne, per tonne-kilometre and one-way distance to the primary elevator was not consistent, as shown in Table 59. It was expected that a negative relationship would exist between the average cost per tonne-kilometre and the one-way distance to the elevator, that is, the average unit cost would decrease with the increase in distance. The average cost per tonne ranged from 227 cents for trucks in the up to 11 kilometres group to 529 cents for trucks in the 15.1-19.0 kilometres category.

The average cost per tonne-kilometre was the lowest at 10.42 cents for trucks in the 15.1 to 19.0 kilometres group and the highest at 20.92 cents for trucks in the 19.1 to 23 kilometres group. Farm trucks travelling over 23 kilometres one-way distance to the elevator exhibited a cost of 16.23 cents per tonne-kilometre. Because of considerable variation in the utilization level of farm trucks, no consistent trend was observed in unit costs.

Average total grain transportation costs showed an upward trend as one-way distance to elevators increased. Farm trucks in the over 23 kilometres group showed lower total costs than the previous group. Fixed costs as per cent of total grain transportation costs, with the exception of trucks in the up to 11 kilometres group, also showed an upward trend.

TABLE 59

RELATIONSHIP BETWEEN ONE-WAY DISTANCE TO ELEVATOR AND GRAIN TRANSPORTATION COSTS,

WESTCENTRAL DISTRICT - NO.5, ALBERTA

	One-Way Distance to Elevator in Kilometres					
	0-11.0	11.1-15.0	15.1-19.0	19.1-23.0	Over 23.0	All Trucks
Average One-Way Distance to Elevator (kilometres)	7.0	12.5	16.1	20.3	29.3	16.1
Number in Sample	27	16	2	10	20	75
Average Cost/Tonne (cents)	227	283	529	510	469	341
Average Cost/Tonne-Kilometre (cents)	20.66	19.13	10.42	20.92	16.23	18.24
Average Cost/Grain-Kilometre (cents)	108.81	92.93	70.04	94.32	77.02	89.62
Average Total Grain Transportation Costs ($)	1222.39	1218.59	1876.25	2400.65	2034.95	1612.80
Fixed Cost as a Per cent of Total Grain Transportation Costs	38.50	36.41	18.15	43.03	44.08	40.31
Average Total Tonnes Transported	537.3	430.3	354.8	470.5	433.8	473.1
Average Total Tonne-Kilometres	5 916	6 369	18 013	11 476	12 541	8 843
Average Total Grain-Kilometres	1 123	1 311	2 679	2 545	2 642	1 800
Average Annual Truck Kilometres	4 988	4 928	9 654	4 312	7 103	5 573

As mentioned above, utilization levels for various groups of trucks showed considerable variation in terms of tonnes transported, tonne-kilometres and grain-kilometres. Average annual truck kilometres (another measure of truck utilization) also exhibited a considerable variation among different groups of trucks.

Relationship Between Size of Farm, Annual Truck Kilometres, Tonnes Transported, Tonne-Kilometres, and Grain Transportation Costs

Size of Farm:

The relationship between size of farm and average unit costs was not consistent as shown in Table 60. The average cost per tonne ranged from 249 cents for trucks on farms 961-1,280 acres to 435 cents for trucks on farms over 1,600 acres. The average cost per tonne-kilometre ranged from 13.70 cents for trucks on the 961-1,280 acre farms to 25.89 cents for trucks on the 641-960 acre farms. It was 18.08 cents for trucks on farms of over 1,600 acres.

Total grain transportation cost exhibited an upward trend as size of farm in acres increased. Farm trucks in the 641-960 acre size group showed considerably higher total costs because of the high proportion of fixed costs (49.62 per cent). As expected truck utilization in terms of total tonnes transported and total tonne-kilometres showed a positive relationship with size of farm in acres.

Annual Truck Kilometres:

Annual truck kilometres is another measure of level of utilization of farm trucks used to transport grain from farms to primary elevators and other sales outlets (Table 61). The relationship between average annual truck kilometres and average cost per tonne was inconclusive. The average cost per tonne ranged from 316 cents for trucks in the 7,241-9,654 kilometres group to 438 cents for trucks in the over 9,654 kilometres group.

TABLE 60

RELATIONSHIP BETWEEN SIZE OF FARM IN ACRES AND GRAIN TRANSPORTATION COSTS,

WESTCENTRAL DISTRICT - NO.5, ALBERTA

	Size of Farm in Acres					
	Up to 640	641-960	961-1280	1281-1600	Over 1600	All Trucks
Average Size of Farm In Acres	494	813	1 091	1 500	4 575	1 872
Number in Sample (grain trucks)	15	18	15	7	20	75
Average Cost/Tonne (cents)	257	351	249	372	435	341
Average Cost/Tonne-Kilometre (cents)	18.28	25.89	13.70	16.85	18.08	18.24
Average Cost/Grain-Kilometre (cents)	74.48	117.44	83.66	80.79	89.19	89.62
Average Total Grain Transportation Costs ($)	992.85	1475.52	1255.51	2220.67	2256.53	1612.80
Fixed Cost as Per cent of Total Grain Transportation Costs	35.58	49.62	25.75	37.47	43.43	40.31
Average One-Way Distance to Elevator (kilometres)	14.7	14.2	14.3	12.4	21.6	16.1
Average Total Tonnes Transported	386.1	420.6	504.0	597.6	518.8	473.1
Average Total Tonne-Kilometres	5 431	5 699	9 166	12 152	14 482	8 843
Grain Kilometres as Per cent of Annual Truck Kilometres	23.15	36.32	33.39	42.71	32.26	32.30
Average Annual Truck Kilometres	5 759	3 459	4 494	6 436	7 844	5 573

The relationship between annual truck kilometres and average cost per tonne-kilometre was negative, as exhibited by the results in Table 61. It was hypothesized that average unit costs per tonne-kilometre would decrease with the increase in annual truck kilometres. The average cost per tonne-kilometre ranged from 14.48 cents for trucks in the over 9,654 kilometres group to 39.07 cents for trucks in the up to 1,609 kilometres category.

Total grain transportation costs increased in relationship to the increase in annual truck kilometres. Considerable fluctuation was observed among the various groups of trucks as to total tonnes transported. The total tonne-kilometres showed a positive relationship with annual truck kilometres, i.e., tonne-kilometres of service provided by farm trucks increased with the increase in annual truck kilometres.

Tonnes Transported:

The relationship between average cost per tonne and tonnes of grain transported was not as expected (Table 62). The average cost per tonne ranged from 257 cents for trucks in the 1,901-286 tonne group to 534 cents for trucks in the 95.1-198 tonne group. Similarly, the average cost per tonne-kilometre did not show any consistent relationship with total tonnes transported. It was hypothesized that average unit costs would be lower for trucks hauling a larger number of tonnes of grain to elevators and other sales outlets.

The average cost per tonne-kilometre ranged from a high of 24.19 cents for trucks in the category of up to 95 tonnes to a low of 13.36 cents for trucks in the 381.1-476 tonne group. It was 18.30 cents for trucks transporting over 571 tonnes of grain. The negative relationship could not be observed as hypothesized because trucks with higher unit costs showed a relatively higher percentage of fixed costs and a lower utilization level in terms of tonne-kilometres of service provided.

Tonne-Kilometres:

The average cost per tonne showed a negative relationship with tonne-kilometres of service. Exceptions to this relationship were for

TABLE 61

RELATIONSHIP BETWEEN ANNUAL TRUCK KILOMETRES AND GRAIN TRANSPORTATION COSTS,

WESTCENTRAL DISTRICT - NO.5, ALBERTA

	Annual Truck Kilometres						
	0-1609	1610-3218	3219-4827	4828-7240	7241-9654	Over 9654	All Trucks
Average Annual Truck Kilometres	1 176	2 950	4 482	6 134	8 528	14 106	5 573
Number in Sample	13	12	14	15	15	6	75
Average Cost/Tonne (cents)	435	266	289	397	316	438	341
Average Cost/Tonne-Kilometre (cents)	39.07	23.55	18.36	17.01	16.16	14.48	18.24
Average Cost/Grain-Kilometre (cents)	207.84	98.88	102.27	75.62	78.70	72.22	89.62
Average Total Grain Transportation Costs ($)	1037.23	899.69	1703.99	1735.16	2152.45	2418.32	1612.80
Fixed Cost as Per cent of Total Grain Transportation Costs	47.48	37.97	43.96	41.34	36.34	38.57	40.31
Average Total Tonnes Transported	238.6	338.04	589.4	436.7	680.8	552.1	473.1
Average Total Tonne-Kilometres	2 655	3 820	9 281	10 198	13 320	16 697	8 843
Grain Kilometres as Per cent of Annual Truck Kilometres	42.44	30.85	37.17	37.40	32.07	22.20	32.30

TABLE 62

RELATIONSHIP BETWEEN TOTAL TONNES TRANSPORTED AND GRAIN TRANSPORTATION COSTS, WESTCENTRAL DISTRICT - NO.5, ALBERTA

	Tonnes Transported							
	0-95.0	95.1-190.0	190.1-286.0	286.1-381.0	381.1-476.0	476.1 571.0	Over 571.0	All Trucks
Average Total Tonnes Transported	49.9	139.8	254.3	340.0	432.0	516.1	861.2	473.1
Number in Sample	8	10	9	10	7	5	26	75
Average Cost/Tonne (cents)	415	534	257	483	236	378	324	341
Average Cost/Tonne-Kilometre (cents)	24.19	19.90	20.48	17.91	13.36	20.28	18.30	18.24
Average Cost/Grain-Kilometre (cents)	83.80	69.46	82.84	85.07	70.41	86.34	97.63	89.62
Average Total Grain Transportation Costs ($)	206.98	746.83	654.34	1643.66	1018.59	1948.80	2793.70	1612.80
Fixed Cost as Per cent of Total Grain Transportation Costs	36.35	33.64	38.17	45.14	24.07	45.58	41.05	40.31
Average Total Tonne-Kilometres	856	3 753	3 194	9 189	7 624	9 608	15 266	8 843
Average Total Grain-Kilometres	247	1 075	790	1 932	1 447	2 257	2 861	1 800
Average Annual Truck Kilometres	1 549	6 613	4 130	4 795	6 551	6 013	6 863	5 573

trucks in the 3055.1-3746.0 and over 766.0 tonne-kilometres categories. The average cost per tonne was 331 cents, 307 cents and 233 cents per tonne for trucks in the first three categories. It rose to 303 cents for trucks in the 3,065-5,746 tonne-kilometres group and decreased to the lowest level at 217 cents for trucks in the 5,746 to 7,662 tonne-kilometres group. The average cost per tonne was the highest for trucks that provided over 7,662 tonne-kilometres of service.

The relationship between total tonne-kilometres and average cost per tonne-kilometre was negative as shown in Table 63. It ranged from a high a 50.63 cents for trucks in the up to 766 tonne-kilometres of service. No discernable relationship was observed between average cost per grain-kilometre and total tonne-kilometres.

Total grain transportation costs showed an upward trend in relationship to the increase in total tonne-kilometres. The average total tonnes transported and average total number of grain-kilometres also exhibited a positive relationship with average tonne-kilometres.

TABLE 63

RELATIONSHIP BETWEEN TOTAL TONNE-KILOMETRES AND GRAIN TRANSPORTATION COSTS, WESTCENTRAL DISTRICT - NO.5, ALBERTA

	Tonne-Kilometres						
	Up to 766.0	766.1-1532.0	1532.1-3065.0	3065.1-5746.0	5746.1-7662.0	Over 7662.0	All Trucks
Average Total Tonne-Kilometres	440	1 081	2 454	4 332	6 783	16 677	8 843
Number in Sample	6	5	9	15	10	30	75
Average Cost/Tonne (cents)	331	307	233	303	217	401	341
Average Cost/Tonne-Kilometre (cents)	50.63	37.72	22.33	21.44	21.36	16.84	18.24
Average Cost/Grain-Kilometre (cents)	172.88	149.74	83.33	84.78	98.51	87.95	89.62
Average Total Grain Transportation Costs ($)	222.53	407.66	547.96	928.66	1449.07	2807.81	1612.80
Fixed Cost as Per cent of Total Grain Transportation Costs	43.50	50.23	32.82	37.85	35.19	41.74	40.31
Average Total Tonnes Transported	67.2	132.6	235.5	306.2	667.5	700.9	473.1
Average Total Grain-Kilometres	129	272	658	1 095	1 471	3 192	1 800
Average One-Way Distance to Elevator (kilometres)	12.3	11.6	12.5	16.8	12.7	19.5	16.1

SECTION X

AVERAGE TOTAL COSTS OF TRANSPORTING GRAIN BY FARM TRUCK IN NORTHEASTERN DISTRICT - NO.6

Total Costs of Grain Transportation

All of the cost components presented in Table 64, except for driving labor and dead-haul labor, have been weighted by grain-kilometres as a proportion of total annual truck kilometres. Therefore, the costs shown in Table 64 are not the total annual costs for a farm truck, rather, these are the portions of all costs attributable to transportation of grain from farm to primary elevators and other sales outlets. Driving and dead-haul labor costs represent the actual costs associated with transporting of grain to market outlets.

Total grain transportation cost per farm truck was calculated to be $1,521.45 during the 1983-84 crop year. Total fixed cost per truck was $600.78 or 39.49 per cent of total grain transportation costs.

The largest component of grain transportation costs was interest on investment at $282.94 (18.60 per cent) of the total costs. It was followed by dead-haul labor (17.02 per cent), depreciation (16.53 per cent) and fuel (14.95 per cent).

On the whole, the 81 farm trucks reported in the northeastern district transported 37,009 tonnes of grain to primary elevators and other sales outlets. In terms of tonne-kilometres, these trucks provided 696,843 tonne-kilometres of service in transporting grain from farms to various market outlets.

Unit Costs of Transporting Grain by Farm Truck

Three types of average unit costs were calculated to present unit costs per tonne, per tonne-kilometre, and per grain-kilometre. The

TABLE 64

AVERAGE TOTAL COSTS OF TRANSPORTING GRAIN PER FARM TRUCK

IN NORTHEASTERN DISTRICT - NO.6, ALBERTA

Variable Costs

	Lubric	Parts	Tires and Batteries	Maintenance and Repair Labor	Fuel	Driving Labor	Dead-Haul Labor	Total Variable Costs
Dollars	28.33	93.44	61.71	39.26	227.55	211.45	258.93	920.67
Per cent	1.86	6.14	4.06	2.58	14.95	13.90	17.02	60.51

Fixed Costs

	Depreciation	Interest on Investment	License	Insurance	Fixed Costs	Total Grain Transportation Costs
Dollars	251.45	282.94	15.51	50.88	600.78	1521.45
Per cent	16.53	18.60	1.02	3.34	39.49	100.00

average costs for each unit in the northeastern district are presented in Table 65. Average costs were divided into variable costs and fixed costs.

The average cost per tonne was calculated to be 333 cents, of which 202 cents were for the variable portion of total costs and 131 cents for fixed costs. On a tonne-kilometre basis, the average cost was calculated to be 17.69 cents (10.74 cents for variable costs and 6.98 cents for fixed costs).

On a grain-kilometre basis, the average cost of transporting an average load of grain one kilometre was 88.59 cents. The average variable cost per grain-kilometre was 53.61 cents, and average fixed cost per grain-kilometre was 34.98 cents.

Average cost per bushel, per bushel-mile, and per grain-miles are presented in brackets in Table 65.

Costs of Transporting Grain and Its Relationship With Size and Age of Truck

Size of Truck:

The size of truck was measured in (i) gross vehicle weight (kg) and (ii) capacity of grain box in tonnes.

The relationship between size of truck measured by gross vehicle weight in kilograms and average cost per tonne-kilometre was negative (Table 66). The average cost per tonne-kilometre ranged from 24.12 cents for trucks in the category of up to 10,000 kg, (GVW) to 16.35 cents for trucks with over 14,000 kg, gross vehicle weight. The negative relationship indicated that as size of farm truck increased in terms of gross vehicle weight, the average cost per tonne-kilometre decreased; it rose sharply when size of truck decreased. For example, trucks weighing less than 10,000 kg, gross vehicle weight showed the highest cost per tonne-kilometre (24.12 cents) when compared to trucks in other categories.

TABLE 65

UNIT COSTS OF TRANSPORTING GRAIN BY FARM TRUCK

IN NORTHEASTERN DISTRICT - NO.6, Alberta

Units	Average Variable Cost	Average Fixed Cost	Average Cost
	Cents	Cents	Cents
Tonne*	202	131	333
(Bushel)	(4.81)	(3.12)	(7.93)
Tonne-Kilometre**	10.71	6.98	17.69
(Bushel-Mile)	(0.41)	(0.27)	(0.68)
Grain-Kilometre	53.61	34.98	88.59
(Grain-Mile)	(86.26)	(56.28)	(142.54)

* 1 tonne = 42 bushels
** 1 kilometre = 0.6216 miles

TABLE 66

RELATIONSHIP BETWEEN SIZE OF TRUCK (MEASURED BY GROSS VEHICLE WEIGHT) AND GRAIN TRANSPORTATION COSTS, NORTHEASTERN DISTRICT - NO.6, ALBERTA

	Gross Vehicle Weight in Kilograms				
	Up to 10,000	10,001-12,000	12,001-14,000	Over 14,000	All Trucks
Average Size of Truck (Kg)	6 503	9 276	10 589	19 939	14 289
Number in Sample	12	10	33	26	81
Average Cost/Tonne (cents)	391	400	293	351	333
Average Cost/Tonne-Kilometre (cents)	24.12	21.90	17.63	16.35	17.69
Average Cost/Grain-Kilometre (cents)	81.10	85.23	76.63	104.40	88.59
Average Total Grain Transportation Costs ($)	783.64	1155.50	1395.73	2162.30	1521.45
Fixed Cost as Per cent of Total Grain Transportation Costs	37.09	38.64	38.41	40.95	39.49
Average Total Tonnes Transported	200.7	288.7	476.0	615.4	456.9
Average Total Tonne-Kilometres	3 248	5 277	7 915	13 227	8 603
Average Total Grain-Kilometres	966	1 356	1 821	2 071	1 715

A positive relationship was observed between size of truck an average total grain transportation costs. Average total tonne transported, average total tonne-kilometres and grain-kilometres, showe upward trends in relationship to size of truck measured in GVW.

The relationship between size of truck measured by capacity of grai box in tonnes and average unit costs is shown in Table 67. The averag cost per tonne-kilometre showed a negative relationship with capacity o grain box in tonnes as hypothesized. It ranged from a high of 31.6(cents for trucks in the group with up to 7 tonnes capacity of grain box to a low of 16.45 cents for trucks in the over 9.5 tonne category.

Total grain transportation costs exhibited an upward trend with the increase in capacity of grain box. Fixed costs as per cent of total grain transportation costs were higher for trucks with larger grain boxes. Other measures of truck utilization (tonnes transported, tonne-kilometres and grain-kilometres) increased with the increase in capacity of grain box in tonnes. The positive relationship indicated that bigger trucks were used more compared to trucks with smaller box capacities.

Age of Truck:

The relationship between age of truck and average unit cost was not consistent as shown by the results in Table 68. The average cost per tonne ranged from 281 cents for trucks in the 1970-74 age group to 391 cents for trucks in the 1980-84 category.

The average cost per tonne-kilometre was 20 cents for trucks in the 1964 and older category; it dropped to 19.66 cents for trucks in the 1965-69 group; it further decreased to 16.26 cents for trucks in the 1970-74 group; it slightly increased to 16.96 cents for trucks in the 1975-79 group; and rose to 18.64 cents for trucks in the 1980-84 group. The higher average cost per tonne-kilometre for older trucks (1964 and older) could be attributed to high repair and maintenance costs and relatively lower utilization levels. As expected, fixed costs as per cent of total grain transportation costs increased as the model of truck became newer. The relationship between age of truck and different utilization levels appeared to be positive.

TABLE 67

RELATIONSHIP BETWEEN SIZE OF TRUCK (MEASURED BY CAPACITY OF GRAIN BOX IN TONNES) AND GRAIN TRANSPORTATION COSTS, NORTHEASTERN DISTRICT - NO.6, ALBERTA

	Capacity of Grain Box in Tonnes			
	0-7.0	7.1-9.5	Over 9.5	All Trucks
Average Capacity of Grain Box (t)	5.6	8.5	12.8	9.3
Number in Sample	14	42	25	81
Average Cost/Tonne (cents)	320	322	347	333
Average Cost/Tonne-Kilometre (cents)	31.60	17.76	16.45	17.69
Average Cost/Grain-Kilometre (cents)	95.81	75.86	105.87	88.59
Average Total Grain Transportation Costs ($)	641.06	1389.08	2236.86	1521.45
Fixed Cost as Per cent of Total Grain Transportation Costs	37.22	37.45	41.97	39.49
Average Total Tonnes Transported	200.2	430.9	644.2	456.9
Average Total Tonne-Kilometres	2 028	7 822	13 596	8 603
Average Total Grain-Kilometres	670	1 831	2 113	1 715

TOTAL 68

RELATIONSHIP BETWEEN AGE OF TRUCK AND GRAIN TRANSPORTATION COSTS, NORTHEASTERN DISTRICT - NO.6, ALBERTA

	Year of Truck					
	1964 And Older	1965-1969	1970-1974	1975-1979	1980-1984	All Trucks
Average Year of Truck	1960	1967	1973	1977	1981	1973
Number in Sample	10	14	18	25	14	81
Average Cost/Tonne (cents)	333	337	281	326	391	333
Average Cost/Tonne-Kilometre (cents)	20.00	19.66	16.26	16.96	18.64	17.69
Average Cost/Grain-Kilometre (cents)	75.17	80.03	77.18	89.98	105.05	88.59
Average Total Grain Transportation Costs ($)	916.02	789.93	1237.89	1851.27	2461.03	1521.45
Fixed Cost as Per cent of Total Grain Transportation Costs	27.47	28.75	32.67	36.50	54.55	39.49
Average Total Tonnes Transported	275.0	234.6	440.9	568.7	629.9	456.9
Average Total Tonne-Kilometres	4 581	4 017	7 612	10 918	13 202	8 603
Averge Total Grain-Kilometres	1 219	987	1 604	2 057	2 343	1 715
Average Annual Truck Kilometres	2 824	3 781	4 961	7 054	5 839	5 291

Relationship Between One-Way Distance to Elevator and Grain Transportation Costs

The relationship between one-way distance to elevator and average unit costs is shown in Table 69. It was hypothesized that the relationship between one-way distance to the elevator and the average cost per tonne-kilometre would be negative. The hypothesis was supported by the data for all categories of trucks, except for trucks in the 15.1 to 19 kilometres category, which showed significantly higher costs than expected. The negative relationship indicated that average costs per tonne-kilometre decreased as distance to elevator increased. The average cost per tonne-kilometre ranged from 10.76 cents for trucks in the over 23 kilometres group to 22.49 cents for trucks in the 15.1 to 19 kilometres group.

No discernable relationship was observed between different levels of truck utilization and the one-way distance to the elevator.

Relationship Between Size of Farm, Annual Truck Kilometres, Tonnes Transported, Tonne-Kilometres and Grain Transportation Costs

Size of Farm:

A less direct measure of truck utilization might be the size of farm in acres (Table 70). In general one would expect that trucks would be utilized more on larger farms than on smaller farms. The expectation was substantiated when the relationship between size of farm in acres and utilization of farm trucks was examined. The highest use in terms of tonnes transported, tonne-kilometres of service and grain-kilometres was for trucks on farms of over 1,600 acres. As shown in Table 70 tonnes of grain transported to market outlets increased with the increase in size of farm, except for trucks on farms of 1,281-1,600 acres.

The average cost per tonne-kilometre ranged from 22-51 cents for trucks on farms of up to 640 acres, to 12.98 cents for trucks on farms of over 1,600 acres farms. The relationship between average cost per

TABLE 69

RELATIONSHIP BETWEEN ONE-WAY DISTANCE TO ELEVATOR AND GRAIN TRANSPORTATION COSTS, NORTHEASTERN DISTRICT - NO.6, ALBERTA

	One-Way Distance to Elevator in Kilometres					
	0-11.0	11.1-15.0	15.1-19.0	19.1-23.0	Over 23.0	All Trucks
Average One-Way Distance to Elevator (kilometres)	10.7	12.7	16.5	21.5	30.6	13.2
Number in Sample	28	28	12	8	5	81
Average Cost/Tonne (cents)	240	326	506	376	462	333
Average Cost/Tonne-Kilometre (cents)	20.70	17.28	22.49	15.81	10.76	17.69
Average Cost/Grain-Kilometre (cents)	95.05	82.72	111.50	87.63	64.44	88.59
Average Total Grain Transportation Costs ($)	1026.05	1553.77	1805.73	2639.02	1644.37	1521.45
Fixed Cost as a Per cent of Total Grain Transportation Costs	37.35	37.75	55.40	28.31	42.91	39.49
Average Total Tonnes Transported	427.7	476.7	357.02	702.3	355.7	456.9
Average Total Tonne-Kilometres	3 957	8 992	8 030	16 687	15 283	8 603
Average Total Grain-Kilometres	1 080	1 878	1 619	3 011	2 552	1 715
Average Annual Truck Kilometres	3 744	6 057	4 224	6 999	9 493	5 291

TABLE 70

RELATIONSHIP BETWEEN SIZE OF FARM IN ACRES AND GRAIN TRANSPORTATION COSTS, NORTHEASTERN DISTRICT - NO.6, ALBERTA

	Size of Farm in Acres					
	Up to 640	641-960	961-1280	1281-1600	Over 1600	All Trucks
Average Size of Farm In Acres	445	806	1 095	1 532	1 962	930
Number in Sample (grain trucks)	28	24	8	15	6	81
Average Cost/Tonne (cents)	367	327	347	321	294	333
Average Cost/Tonne-Kilometre (cents)	22.51	20.53	16.14	14.70	12.98	17.69
Average Cost/Grain-Kilometre (cents)	95.14	102.69	69.03	90.31	73.93	88.59
Average Total Grain Transportation Costs ($)	1121.75	1509.26	2105.12	1633.62	2376.85	1521.45
Fixed Cost as Per cent of Total Grain Transportation Costs	43.51	41.44	34.54	37.68	34.63	39.49
Average One-Way Distance to Elevator (kilometres)	13.0	12.1	11.9	15.0	16.1	13.2
Average Total Tonnes Transported	305.9	462.1	607.0	509.2	809.3	456.9
Average Total Tonne-Kilometres	4 983	7 351	13 040	11 114	18 312	8 603
Grain-Kilometres as Per cent of Annual Truck Kilometres	34.92	28.18	45.26	25.44	39.96	32.41
Average Annual Truck Kilometres	3 376	5 216	6 738	7 112	8 045	5 291

tonne-kilometre and size of farm was negative, indicating that trucks larger farms had a higher utilization level in terms of tonne-kilometr of service resulting in lower unit costs.

Annual Truck Kilometres:

Total annual truck kilometres was another measure of utilization farm trucks used in transporting grain to various market outlets. Th relationship between annual truck kilometres and average unit costs wa negative as indicated by the results in Table 71. It was hypothesize that average unit costs would decrease with the increase in use of truck in terms of annual distance travelled. The hypothesis was supported b the relationship between average cost per tonne-kilometre and annua truck kilometres. The average cost per tonne-kilometre was the highes (51.73 cents) for trucks in the up to 1,609 kilometre group and th lowest at 12.06 cents for trucks in the over 9,654 kilometres group

Total grain transportation costs showed an upward trend, except fo trucks in the 7,241-9,554 kilometres group. The average total costs fo trucks in this group dropped considerably from the previous group. Th relationship between other measures of truck utilization and annual truck kilometres was positive as expected.

Tonnes Transported:

The relationship between tonnes of grain transported and average cost per tonne-kilometre was negative as shown in Table 72. The average cost per tonne-kilometre was 39.34 cents for trucks transporting an average up to 95 tonnes and 14.39 cents for trucks transporting over 571 tonnes. The negative relationship showed that the average cost per tonne-kilometre decreased with the increase in tonnes of grain transported.

The total grain transportation costs exhibited a positive relationship with tonnes transported except for trucks in the 476.1-571 tonne group. No discernable relationship was observed between tonnes of grain transported and fixed costs as per cent of total grain transportation costs.

TABLE 71

RELATIONSHIP BETWEEN ANNUAL TRUCK KILOMETRES AND GRAIN TRANSPORTATION COSTS, NORTHEASTERN DISTRICT - NO.6, ALBERTA

	Annual Truck Kilometres						
	Up to 1609	1610-3218	3219-4827	4828-7240	7241-9654	Over 9654	All Trucks
Average Annual Truck Kilometres	1 131	2 643	4 659	6 158	8 179	14 481	5 291
Number in Sample	16	14	24	11	6	10	81
Average Cost/Tonne (cents)	483	422	357	284	236	305	333
Average Cost/Tonne-Kilometre (cents)	51.73	24.13	19.68	17.77	13.90	12.06	17.69
Average Cost/Grain-Kilometre (cents)	220.33	99.40	93.67	80.74	74.14	71.25	88.59
Average Total Grain Transportation Costs ($)	679.34	1115.19	1705.91	1706.56	1458.23	2829.22	1521.45
Fixed Cost as Per cent of Total Grain Transportation Costs	45.47	48.92	45.91	38.62	29.76	26.26	39.49
Average Total Tonnes Transported	140.6	264.6	477.7	601.0	617.8	926.9	456.9
Average Total Tonne-Kilometres	1 313	4 622	8 667	9 603	10 491	23 453	8 603
Grain-Kilometres as Per cent of Annual Truck Kilometres	27.25	42.44	39.08	34.32	24.05	27.42	32.41

TABLE 72

RELATIONSHIP BETWEEN TOTAL TONNES TRANSPORTED AND GRAIN TRANSPORTATION COSTS, NORTHEASTERN DISTRICT - NO.6, ALBERTA

	Tonnes Transported							
	Up to 95.0	95.1-190.0	190.1-286.0	286.1-381.0	381.1-476.0	476.1 571.0	Over 571.0	All Trucks
Average Total Tonnes Transported	54.1	141.1	245.5	338.9	412.2	526.5	960.1	456.9
Number in Sample	7	10	11	18	6	9	20	81
Average Cost/Tonne (cents)	557	410	383	410	584	293	269	333
Average Cost/Tonne-Kilometre (cents)	39.34	31.03	22.31	21.52	20.84	16.95	14.39	17.69
Average Cost/Grain-Kilometre (cents)	101.67	120.18	111.91	91.45	111.96	81.48	78.64	88.59
Average Total Grain Transportation Costs ($)	301.47	578.57	940.89	1388.76	2409.15	1543.00	2582.61	1521.45
Fixed Cost as Per cent of Total Grain Transportation Costs	36.19	36.54	41.73	42.53	58.21	31.67	34.90	39.49
Average Total Tonne-Kilometres	766	1 864	4 217	6 452	11 558	9 103	17 952	8 603
Average Total Grain-Kilometres	297	481	841	1 519	2 152	1 894	3 284	1 715
Average Annual Truck Kilometres	1 368	2 285	4 227	4 398	4 720	7 330	8 809	5 291

Tonne-Kilometres:

When truck utilization was measured by total tonne-kilometres of service provided, the relationship with average cost per tonne-kilometre was negative as indicated in Table 73. The average cost per tonne-kilometre ranged from a high of 71.68 cents for trucks providing up to 766 tonne-kilometres of service to a low of 15.21 cents for trucks in the over 7,662 tonne-kilometre group. The negative relationship between total tonne-kilometre and average cost per tonne-kilometre showed that as tonne-kilometres of service increased, the average unit cost decreased. It supported the hypothesis that as the utilization of trucks increased, average cost per tonne-kilometre decreased.

Total grain transportation costs showed a positive relationship with total tonne-kilometres; that is, as total tonne-kilometres of service increased, total grain transportation costs also increased. The total tonnes transported and grain-kilometres showed upward trends with the increase in total tonne-kilometres. The average one-way distance to elevators also followed an upward trend with the exception of trucks in the over 7 662 group.

Results presented in Table 73 and the preceding tables showed that the greater the levels of utilization of farm trucks, the lower the average unit cost.

TABLE 73

RELATIONSHIP BETWEEN TOTAL TONNE-KILOMETRES AND GRAIN TRANSPORTATION COSTS, NORTHEASTERN DISTRICT - NO.6, ALBERTA

	Tonne-Kilometres						
	Up to 766.0	766.1-1532.0	1532.1-3065.0	3065.1-5746.0	5746.1-7662.0	Over 7662.0	All Trucks
Average Total Tonne-Kilometres	360	1 187	2 376	4 201	6 606	15 951	8 603
Number in Sample	5	9	10	14	9	34	81
Average Cost/Tonne (cents)	520	372	293	334	320	334	333
Average Cost/Tonne-Kilometre (cents)	71.68	54.53	28.60	25.97	19.46	15.21	17.69
Average Cost/Grain-Kilometre (cents)	135.49	197.83	119.31	107.81	82.74	81.38	88.59
Average Total Grain Transportation Costs ($)	258.12	627.22	679.58	1090.85	1285.18	2426.11	1521.45
Fixed Cost as Per cent of Total Grain Transportation Costs	35.69	43.17	36.41	41.82	32.78	40.05	39.49
Average Total Tonnes Transported	49.7	174.0	231.6	326.2	401.9	726.2	456.9
Average Total Grain-Kilometres	191	327	570	1 012	1 553	2 981	1 715
Average One-Way Distance to Elevator (kilometres)	6.8	8.2	10.1	14.1	15.9	15.3	13.2

SECTION XI

AVERAGE TOTAL COSTS OF TRANSPORTING BY FARM TRUCK IN NORTHWESTERN DISTRICT - NO.7

Total Costs of Grain Transportation

All of the cost components presented in Table 74, except for driving labor and dead-haul labor, have been weighted by grain-kilometres as a proportion of total annual truck kilometres. Thus, the costs shown in Table 74, are not the total annual costs for a farm truck, rather, these are the portions of all costs attributable to transportation of grain from farm to primary elevators and other sales outlets.

Total grain transportation cost per farm truck in the northwestern district was calculated to be $1,435.41 for the 1983-84 crop year. Total fixed cost per farm truck amounted to $534.03 or 37.20 per cent of total grain transportation costs.

The largest component of grain transportation costs was interest on investment, which accounted for 17.21 per cent of total costs. It was followed by depreciation at 15.11 per cent, fuel at 14.74 per cent and driving labor at 13.10 per cent.

On the whole, the 67 farm trucks reported in the northwestern district transported 26,512 tonnes of grain to primary elevators and other sales outlets. In terms of tonne-kilometres, farm trucks in the sample provided 670,045 tonne-kilometres of service in transporting grain from farms to primary elevators and other sales outlets.

Unit Costs of Transporting Grain by Farm Truck

Three types of average costs were calculated to present costs on a unit basis, the units being the tonne, the tonne-kilometre, and the grain-kilometre. The various unit costs are shown in Table 75.

TABLE 74

AVERAGE TOTAL COSTS OF TRANSPORTING GRAIN PER FARM TRUCK

IN NORTHWESTERN DISTRICT - NO.7, ALBERTA

Variable Costs

	Lubric	Parts	Tires and Batteries	Maintenance and Repair Labor	Fuel	Driving Labor	Dead-Haul Labor	Total Variable Costs
Dollars	29.48	155.94	84.55	50.06	211.52	188.05	181.78	901.38
Per cent	2.05	10.87	5.89	3.49	14.74	13.10	12.66	62.80

Fixed Costs

	Depreciation	Interest on Investment	License	Insurance	Fixed Costs	Total Grain Transportation Costs
Dollars	216.84	247.00	14.15	56.04	534.03	1435.41
Per cent	15.11	17.21	0.98	3.90	37.20	100.00

TABLE 75

UNIT COSTS OF TRANSPORTING GRAIN BY FARM TRUCK

IN NORTHWESTERN DISTRICT - NO.7, Alberta

Units	Average Variable Cost	Average Fixed Cost	Average Cost
	Cents	Cents	Cents
Tonne**	228	135	363
(Bushel)	(5.43)	(3.21)	(8.64)
Tonne-Kilometre**	8.89	5.27	14.16
(Bushel-Mile)	(0.34)	(0.20)	(0.54)
Grain-Kilometre	54.14	32.07	86.21
(Grain-Mile)	(87.11)	(51.60)	(136.71)

* 1 tonne = 42 bushels
** 1 kilometre = 0.6216 miles

The average cost of transporting a tonne of grain from farm to primary elevator and other sales outlets in the northwestern district was calculated to be 363 cents during the 1983-84 crop year. The average variable cost was estimated at 228 cents and the average fixed cost at 135 cents.

On a grain-kilometre basis, the average cost of transporting an average load of grain one kilometre was 86.21 cents. The average variable cost per grain-kilometre was 54.14 cents, and the average fixed cost per grain-kilometre was 32.07 cents.

The average unit costs per bushel, per bushel-mile and per grain-mile are presented in brackets in Table 75.

Cost of Transporting Grain and Its Relationship With Size and Age of Truck

Size of Truck:

The size of truck was measured in (i) gross vehicle weight (kg) and (ii) capacity of grain box in tonnes.

The relationship between size of truck measured by gross vehicle weight (GVW) in kilograms and average unit cost per tonne-kilometre was negative, with the exception of trucks in the 12,001-14,000 GVW group (Table 76). The average cost per tonne-kilometre ranged from 11.12 cents for trucks in the over 14,000 GVW category to 24.49 cents for smaller trucks in the up to 10,000 kg, GVW category. Trucks in the 12 0001-14 000 kg, GVW group showed slightly higher unit costs compared to trucks in the previous group. The negative relationship between gross vehicle weight and average cost per tonne-kilometre was hypothesized and supported by the results in Table 76. It indicated that as size of truck increased in terms of GVW, average cost per tonne-kilometre decreased significantly; it rose sharply when size of truck decreased.

A positive relationship existed between size of truck and tonne of grain transported and tonne-kilometres of service, i.e., as size of truck in terms of GVW increased, the volume of grain transported and tonne-kilometres of service also increased.

TABLE 76

RELATIONSHIP BETWEEN SIZE OF TRUCK (MEASURED BY GROSS VEHICLE WEIGHT) AND GRAIN TRANSPORTATION COSTS, NORTHWESTERN DISTRICT - NO.7, ALBERTA

	Gross Vehicle Weight in Kilograms				
	Up to 10,000	10,001-12,000	12,001-14,000	Over 14,000	All Trucks
Average Size of Truck (Kg)	7 303	10 831	12 886	21 327	15 199
Number in Sample	12	7	20	28	67
Average Cost/Tonne (cents)	549	260	501	308	363
Average Cost/Tonne-Kilometre (cents)	24.49	19.18	20.65	11.12	14.16
Average Cost/Grain-Kilometre (cents)	103.90	67.25	81.50	88.77	86.21
Average Total Grain Transportation Costs ($)	750.89	673.94	1492.61	1878.27	1435.41
Fixed Cost as Per cent of Total Grain Transportation Costs	30.02	28.34	43.61	35.59	37.20
Average Total Tonnes Transported	136.7	259.5	298.0	610.6	395.7
Average Total Tonne-Kilometres	3 067	3 514	7 227	16 896	10 135
Average Total Grain-Kilometres	723	1 002	1 832	2 116	1 665

The relationship between size of truck measured by capacity of grai box in tonnes and the average unit cost per tonne was negative as show in Table 77. Similarly the relationship between size of truck an average cost per tonne-kilometre was negative as anticipated. Th average cost per tonne-kilometre was 34.85 cents for trucks with up to tonnes of grain box capacity; it sharply decreased to 18.42 cents fo trucks in the 7.1-9.5 tonnes of grain box capacity; and it furthe decreased to 10.55 cents for trucks with over 9.5 tonnes grain bo capacity.

Total grain transportation cost showed a positive relationship wit size of truck measured by capacity of grain box in tonnes. Truck utilization measured by tonnes of grain transported, tonne-kilometres of service provided and grain-kilometres exhibited a positive relationship, as trucks with bigger boxes were used more for transporting grain than trucks with smaller boxes.

Age of Truck:

Data provided by the study participants in northwestern district were analyzed to obtain unit and total costs by age of truck and to examine the relationship between different utilization levels of farm trucks and age of truck. The relationship between the average unit cost and age of truck was not consistent as shown by the results in Table 78. The average cost per tonne ranged from 297 cents for trucks in the 1970-74 group to 566 cents for trucks in the 1980-84 group. However, new trucks did show higher unit costs over older trucks.

Total grain transportation costs showed an upward trend with the age of truck, except for trucks in the 1970-74 category. That, is the total cost for new trucks was significantly higher than for older trucks. Average fixed costs as per cent of total grain transportation costs showed a positive relationship with age of truck. In other words, fixed costs were considerably higher for new trucks when compared with older trucks.

TABLE 77

RELATIONSHIP BETWEEN SIZE OF TRUCK (MEASURED BY CAPACITY OF GRAIN BOX IN TONNES) AND GRAIN TRANSPORTATION COSTS, NORTHWESTERN DISTRICT - NO.7, ALBERTA

	Capacity of Grain Box in Tonnes			
	Up to 7.0	7.1-9.5	Over 9.5	All Trucks
Average Capacity of Grain Box (t)	5.0	8.4	15.1	9.9
Number in Sample	18	25	24	67
Average Cost/Tonne (cents)	597	363	322	363
Average Cost/Tonne-Kilometre (cents)	34.85	18.42	10.55	14.16
Average Cost/Grain-Kilometre (cents)	91.95	77.87	90.85	86.21
Average Total Grain Transportation Costs ($)	857.73	1287.87	2022.34	1435.41
Fixed Cost as Per cent of Total Grain Transportation Costs	44.24	36.50	35.43	37.20
Average Total Tonnes Transported	143.8	355.0	627.1	395.7
Average Total Tonne-Kilometres	2 461	6 990	19 165	10 135
Average Total Grain-Kilometres	933	1 654	2 226	1 665

TOTAL 78

RELATIONSHIP BETWEEN AGE OF TRUCK AND GRAIN TRANSPORTATION COSTS, NORTHWESTERN DISTRICT - NO.7, ALBERTA

	Year of Truck					
	1964 And Older	1965-1969	1970-1974	1975-1979	1980-1984	All Trucks
Average Year of Truck	1961	1967	1972	1977	1981	1972
Number in Sample	10	12	19	19	7	67
Average Cost/Tonne (cents)	311	300	297	400	566	363
Average Cost/Tonne-Kilometre (cents)	20.63	11.70	12.36	14.37	20.91	14.16
Average Cost/Grain-Kilometre (cents)	85.51	77.36	84.71	85.58	103.77	86.21
Average Total Grain Transportation Costs ($)	386.34	1483.68	1145.61	1929.96	2295.52	1435.41
Fixed Cost as Per cent of Total Grain Transportation Costs	19.90	26.76	30.68	38.97	57.74	37.20
Average Total Tonnes Transported	124.3	495.1	385.3	482.8	405.3	395.7
Average Total Tonne-Kilometres	1 872	12 678	9 267	13 434	10 979	10 135
Averge Total Grain-Kilometres	452	1 918	1 352	2 255	2 212	1 665
Average Annual Truck Kilometres	2 140	5 274	4 886	6 428	5 861	5 085

No discernable relationship was observed between different utilization levels of farm trucks (tonnes transported, tonne-kilometres) and age of truck.

Relationship Between One-Way Distance to Elevator and Grain Transportation Costs

With one exception, the relationship between one-way distance to elevator and average cost per tonne-kilometre was negative (Table 79), that is, as distance to elevator increased, average cost per tonne-kilometre decreased. The exception to this relationship was for trucks in the over 23 kilometres (one-way distance to elevator) category. The average cost per tonne-kilometre for trucks in this group was slightly higher than the costs for trucks in the 19.1-23.0 kilometres group. However, the average unit cost per tonne-kilometre ranged from a low of 11.15 cents for trucks in the 19.1-23.0 kilometres group to a high of 23.03 cents for trucks in the up to 11 kilometre group.

The relationship between different measures of truck utilization and the one-way distance to the elevator was positive; i.e.; trucks travelling longer distances transported higher volumes of grain thus providing higher tonne-kilometres of service compared to trucks travelling relatively shorter distances.

The hypothesis formulated earlier that trucks travelling longer distances would show lower unit costs holds true for trucks in longer distance categories.

Relationship Between Size of Farm, Annual Truck Kilometres, Tonnes Transported, Tonne-Kilometres, and Grain Transportation Costs

Size of Farm:

As size of farm in acres might indirectly give a measure truck utilization, the relationship between unit costs, utilization levels and size of farm was studied. In general, one would expect that trucks would

TABLE 79

RELATIONSHIP BETWEEN ONE-WAY DISTANCE TO ELEVATOR AND GRAIN TRANSPORTATION COSTS, NORTHWESTERN DISTRICT - NO.7, ALBERTA

	One-Way Distance to Elevator in Kilometres					
	Up to 11.0	11.1-15.0	15.1-19.0	19.1-23.0	Over 23.0	All Trucks
Average One-Way Distance to Elevator (kilometres)	5.8	12.7	16.6	19.8	36.8	11.4
Number in Sample	19	12	3	12	21	67
Average Cost/Tonne (cents)	358	318	379	270	362	363
Average Cost/Tonne-Kilometre (cents)	23.03	18.71	17.10	11.15	12.86	14.16
Average Cost/Grain-Kilometre (cents)	103.33	91.58	115.63	74.52	84.09	86.21
Average Total Grain Transportation Costs ($)	687.10	921.89	1535.57	1446.36	2385.32	1435.41
Fixed Cost as Per cent of Total Grain Transportation Costs	38.58	35.55	31.84	29.51	40.37	37.20
Average Total Tonnes Transported	192.8	289.6	405.0	536.1	659.5	395.7
Average Total Tonne-Kilometres	2 982	4 927	8 961	12 978	18 554	10 135
Average Total Grain-Kilometres	665	1 007	1 328	1 941	2 837	1 665
Average Annual Truck Kilometres	3 297	4 183	3 754	6 516	6 589	5 085

to be utilized more on larger farms than on smaller ones. This expectation was quite true, when the relationship between size of farm and total tonnes transported was examined. Truck utilization in terms of tonnes transported and tonne-kilometres of service increased with the increase in size of farm.

The relationship between average costs per tonne; per tonne-kilometre and size of farm in acres was negative as shown in Table 80, with a few exceptions. The average cost per tonne ranged from 280 cents for trucks on farms of over 1,600 acres to 662 cents for trucks on farms of up to 640 acres. Trucks from farms of 641-960 acres showed that is cost 283 cents per tonne to transport grain to market outlets. The average cost per tonne-kilometre was the highest at 23.94 cents for trucks from farms of up to 600 acres and the lowest at 9.54 cents for trucks from the over 1,600 acres farms size group.

The above results indicated that farm trucks were used more on larger farms thus showing lower average unit costs. No discernable relationship was observed between total grain transportation costs and size of farm in acres, although trucks from the over 1,600 acre farms had the highest overall grain transportation costs.

Annual Truck Kilometres:

Annual truck kilometres was another measure of truck utilization for transporting grain to various market outlets. In fact, annual truck kilometres was used as the basis to estimate grain-kilometres to determine grain transportation costs.

The relationship between annual truck kilometres and average unit costs per tonne-kilometre was negative as hypothesized (Table 81). Average cost per tonne-kilometre ranged from a low of 7.42 cents for trucks in the over 9,654 tonne-kilometres category to 38.18 cents for trucks in the up to 1,609 tonne category. The negative relationship indicated that the average cost per tonne-kilometre decreased as annual truck mileage increased.

Total grain transportation costs, total tonnes of grain transported and tonne-kilometres of service exhibited a positive relationship with annual truck kilometres. In other words total grain transportation costs

TABLE 80

RELATIONSHIP BETWEEN SIZE OF FARM IN ACRES AND GRAIN TRANSPORTATION COSTS,

NORTHWESTERN DISTRICT - NO.7, ALBERTA

	Size of Farm in Acres					
	Up to 640	641-960	961-1280	1281-1600	Over 1600	All Trucks
Average Size of Farm In Acres	498	795	1 174	1 489	3 269	1 393
Number in Sample (grain trucks)	20	16	7	9	15	67
Average Cost/Tonne (cents)	662	283	448	336	280	363
Average Cost/Tonne-Kilometre (cents)	23.94	19.58	13.34	16.87	9.54	14.16
Average Cost/Grain-Kilometre (cents)	100.96	83.89	81.74	102.07	74.82	86.21
Average Total Grain Transportation Costs ($)	1302.62	790.28	1725.53	1484.96	2135.47	1435.41
Fixed Cost as Per cent of Total Grain Transportation Costs	41.72	35.57	42.28	35.96	32.78	37.20
Average One-Way Distance to Elevator (kilometres)	19.5	12.5	33.1	18.9	22.1	19.8
Average Total Tonnes Transported	196.9	279.2	385.4	441.4	762.6	395.7
Average Total Tonne-Kilometres	5 441	4 037	12 935	8 801	22 392	10 135
Grain Kilometres as Per cent of Annual Truck Kilometres	36.20	21.44	39.93	31.42	35.56	32.75
Average Annual Truck Kilometres	3 564	4 395	5 287	4 630	8 027	5 085

TABLE 81

RELATIONSHIP BETWEEN ANNUAL TRUCK KILOMETRES AND GRAIN TRANSPORTATION COSTS, NORTHWESTERN DISTRICT NO.7, ALBERTA

	Annual Truck Kilometres						
	Up to 1609	1610-3218	3219-4827	4828-7240	7241-9654	Over 9654	All Trucks
Average Annual Truck Kilometres	1 249	2 928	4 299	6 007	8 313	13 408	5 085
Number in Sample	17	10	13	9	12	6	67
Average Cost/Tonne (cents)	435	454	367	472	372	256	363
Average Cost/Tonne-Kilometre (cents)	38.18	35.61	18.05	16.59	12.83	7.42	14.16
Average Cost/Grain-Kilometre (cents)	159.09	120.39	98.48	85.10	66.75	73.44	86.21
Average Total Grain Transportation Costs ($)	497.50	1250.93	1605.80	1420.38	1917.95	3088.51	1435.21
Fixed Cost as Per cent of Total Grain Transportation Costs	38.06	50.66	38.93	46.64	30.03	28.18	37.20
Average Total Tonnes Transported	114.3	275.7	437.3	303.1	515.3	1206.2	395.7
Average Total Tonne-Kilometres	1 303	3 512	8 896	8 559	14 945	41 623	10 135
Grain Kilometres as Per cent of Annual Truck Kilometres	25.03	35.48	37.79	27.79	34.56	31.36	32.75

and measures of truck utilization showed upward trends with an increase in annual truck kilometres.

Grain-kilometres as a per cent of annual truck kilometers did not show any discernable relationship with annual truck kilometres (Table 81).

Tonnes Transported:

The relationship between tonnes of grain transported and the average unit costs was not as expected (Table 82). It was hypothesized that a negative relationship would be observed between tonnes transported and average costs per tonne and per tonne-kilometres. Although trucks in the over 571 tonne category showed the lowest unit cost, unit costs for other groups of trucks were not consistent. The average cost per tonne-kilometre was the highest (41.24 cents) for trucks in the up to 95 tonne group; it dropped drastically to 24.37 cents for trucks in the 95.1-190 tonne group; it rose marginally to 26.62 cents for trucks in the 190.1-286 tonne group; and showed an inconclusive relationship with the remaining groups. The average cost per tonne-kilometre was 8.94 cents for trucks in the over 571 tonne group. With the exception of trucks in the 476.1-571 tonne category, average total grain transportation costs, total tonne-kilometres and grain-kilometres showed upward trends.

Tonne-Kilometres:

The relationship between total tonne-kilometres (a measure of utilization of farm trucks) and the average cost per tonne-kilometre was negative, with the exception of trucks in the 3,065.1-5,746 tonne-kilometres group. The average cost per tonne-kilometre ranged from a high of 64.70 cents for trucks in the up to 766 tonne-kilometres group to a low of 11.16 cents for trucks in the over 7,662 tonne-kilometre group.

The negative relationship between total tonne-kilometres and average cost per tonne-kilometre showed that as tonne-kilometres increased, average unit costs per tonne-kilometre decreased. Total grain

TABLE 82

RELATIONSHIP BETWEEN TOTAL TONNES TRANSPORTED AND GRAIN TRANSPORTATION COSTS, NORTHWESTERN DISTRICT NO.7, ALBERTA

	Tonnes Transported							
	Up to 95.0	95.1-190.0	190.1-286.0	286.1-381.0	381.1-476.0	476.1 571.0	Over 571.0	All Trucks
Average Total Tonnes Transported	51.2	155.4	247.5	330.6	422.4	516.3	1 001	395.7
Number in Sample	11	11	10	11	6	5	13	67
Average Cost/Tonne (cents)	571	537	531	403	587	298	257	363
Average Cost/Tonne-Kilometre (cents)	41.24	24.37	26.62	16.32	18.17	19.85	8.94	14.16
Average Cost/Grain-Kilometre (cents)	119.85	78.22	105.85	79.42	109.05	88.81	75.99	86.21
Average Total Grain Transported Costs ($)	292.41	833.63	1314.45	1332.75	2478.69	1535.90	2571.48	1435.41
Fixed Cost as Per cent of Total Grain Transportation Costs	29.28	38.71	44.63	37.65	37.45	40.01	33.69	37.20
Average Total Tonne-Kilometres	709	3 421	4 937	8 165	13 639	7 738	29 761	10 135
Average Total Grain-Kilometres	244	1 066	1 242	1 678	2 273	1 729	3 384	1 665
Average Annual Truck Kilometres	1 945	2 852	4 505	5 607	6 034	8 335	7 946	5 085

transportation costs showed a positive relationship with tonne-kilometres, i.e., total grain transportation costs increased with the increase in tonne-kilometres (Table 83).

The average total tonnes transported, total grain-kilometres and the one-way distance to the elevator exhibited upward trends in relationship to tonne-kilometres.

TABLE 83

RELATIONSHIP BETWEEN TOTAL TONNE-KILOMETRES AND GRAIN TRANSPORTATION COSTS, NORTHWESTERN DISTRICT NO.7, ALBERTA

	Tonne-Kilometres						
	Up to 766.0	766.1-1532.0	1532.1-3065.0	3065.1-5746.0	5746.1-7662.0	Over 7662.0	All Trucks
Average Total Tonne-Kilometres	414	1 126	2 558	3 668	6 713	22 694	10 135
Number in Sample	10	4	10	9	10	24	67
Average Cost/Tonne (cents)	364	365	298	331	387	371	363
Average Cost/Tonne-Kilometre (cents)	64.70	49.56	23.70	28.96	22.12	11.16	14.16
Average Cost/Grain-Kilometre (cents)	171.38	235.17	84.42	105.14	85.15	80.88	86.21
Average Total Grain Transportation Costs ($)	268.03	558.12	606.32	1062.37	1484.89	2532.75	1435.41
Fixed Cost as Per cent of Total Grain Transportation Costs	27.65	43.85	27.14	42.25	39.76	36.97	37.20
Average Total Tonnes Transported	73.5	153.1	203.7	320.9	384.0	683.4	395.7
Average Total Grain-Kilometres	156	237	736	1 010	1 744	3 132	1 665
Average One-Way Distance to Elevator (kilometres)	9.5	10.9	13.0	14.3	18.2	31.0	19.8

SECTION XII

DISTRIBUTION OF RESPONDENTS BY SIZE OF FARM AND AGE

Size of Farm and Age of Respondents

The questionnaire used to survey grain producers to obtain data on farm truck costs for transporting grain to various market outlets also included some subjective questions regarding road conditions, weight restrictions, size of farm, selection of trucks, and services at primary elevators, etc. Responses to these and other questions were as follows:

1. Size of Farm: The participants were asked to report on the size of farm in acres. Table 84 shows the distribution of the study participants by size of farm. About 30 per cent of the respondents owned or operated over 1,600 acre farms. Total number of respondents was 376.

2. Age of Respondents: Participants in the survey were requested to indicate their age in order to study the profile of grain producers. Table 85 shows the age characteristics of respondents in each of the seven districts. The number of respondents to the age question was 360. The majority of the study participants were in the 51 to 60 year age group, followed by the 41 to 50 year and 31 to 40 year age groups.

Responses Regarding Road Conditions and Selection of Farm Trucks

1. Road Conditions: The study participants were asked to rank road conditions in their areas that they use for delivering grain to primary elevators and other market outlets. Seven possible concerns were listed and the participants were asked to check as many that apply. Responses are presented in Table 86 by district and overall for the province.

TABLE 84

DISTRIBUTION OF RESPONDENTS BY SIZE OF FARM

Size of Farm (Acres)	Southern District No.1	South-Western District No.2	South-Eastern District No.3	East-Central District No.4	West-Central District No.5	North-Eastern District No.6	North-Western District No.7	TOTAL	Percent of Total
Up to 320	7	0	2	1	3	8	2	23	6.12
321-640	4	12	6	4	12	17	13	68	18.09
641-900	6	7	7	12	12	16	10	70	18.62
901-1 280	11	10	5	12	10	8	7	63	16.76
1 281-1 600	5	6	8	4	4	9	5	41	10.90
Over 1 600	26	19	31	14	9	4	8	111	29.52
TOTAL	59	54	59	47	50	62	45	376	100.00
Percent	15.69	14.36	15.69	12.50	13.30	16.49	11.97	100.00	

TABLE 85

DISTRIBUTION OF RESPONDENTS BY AGE

	District No.1	District No.2	District No.3	District No.4	District No.5	District No.6	District No.7	TOTAL	Percent of Total
Up to 30	6	2	6	7	4	8	7	40	11.11
31 to 40	13	11	9	10	15	7	5	70	19.44
41 to 50	15	11	16	6	15	18	12	93	25.83
51 to 60	18	21	16	11	8	23	13	110	30.56
Over 60	5	6	10	12	6	4	4	47	13.06
TOTAL	57	51	57	46	48	60	41	360	100.00
Percent	15.83	14.17	15.83	12.78	13.33	16.67	11.39	100.00	

TABLE 86

CONDITIONS OF ROAD USED FOR GRAIN DELIVERIES

Concerns	District No.1	District No.2	District No.3	District No.4	District No.5	District No.6	District No.7	TOTAL	Percent
Dangerous Concerns and Blind Spots	9	7	14	8	9	17	5	69	9.41
Steep Hills	19	10	13	13	7	17	4	83	11.32
Required Minor Repairs	22	14	17	18	18	21	16	126	17.19
Required Widening	8	11	12	6	13	18	11	79	10.78
Required Major Repair	10	6	18	9	9	15	8	75	10.23
Required More Regular Grading	15	16	20	14	18	25	15	123	16.78
Roads are Adequate	30	28	28	28	21	22	23	178	24.28
TOTAL	113	92	122	94	95	135	82	733	100.00
Percent	15.42	12.55	16.64	12.82	12.96	18.42	11.19	100.00	

The majority of the respondents (24.28%) indicated that road conditions were adequate for their loaded trucks. About 17 per cent of the responses called for minor repairs followed by more regular grading requirements. Only about nine per cent of the responses indicated that roads they use have dangerous corners and blind spots. Details as to responses and other concerns are given in Table 87.

2. Conditions and Weight Restrictions: The study participants were given four choices to indicate concerns about road conditions and weight restrictions of the most direct routes to transport grain to various market outlets. They were asked to check as many choices as possible that applied to their situation. Table 87 presents a summary of concerns about road conditions and weight restrictions as shown by study participants responses.

Over 45 per cent indicated that because of road conditions and weight restrictions they hauled lighter loads than the maximum allowed. In other words, loads of grain hauled to primary elevators and other market outlets were not the maximum allowable load limits. About 40 per cent of the responses indicated that they drove directly to the closest primary elevator to deliver grain.

3. Road Maintenance: Study participants were asked to indicate if they had to drive farther than necessary to use roads that were better maintained with:

   - gravel
   - oil
   - surfaced or paved

   The responses are presented in Table 88.

About 64 per cent of the responses pointed out that they drove farther to deliver grain than necessary to use roads that were paved or better maintained. Just over 25 per cent reported that they drove farther to deliver grain to primary elevators and other market outlets using roads that were better maintained with gravel. Another 11 per cent drove farther to use roads which were better maintained with oil.

TABLE 87

RESPONSES CONCERNING ROAD CONDITIONS AND WEIGHT RESTRICTIONS

Concerns	District No.1	District No.2	District No.3	District No.4	District No.5	District No.6	District No.7	TOTAL	Percent
Load Few Bushels Than Maximum	36	32	41	30	20	36	27	222	45.40
Detour to the Closest Primary Elevator	5	4	9	3	0	6	4	31	6.34
Drive Farther to my Preferred Primary Elevator	5	8	7	4	7	7	3	41	8.38
Drive Directly to the Closest Primary Elevator	31	25	27	25	32	30	25	195	39.88
TOTAL	77	69	84	62	59	79	59	489	100
Percent	15.75	14.11	17.18	12.68	12.07	16.16	12.07	-	100

TABLE 88

DRIVING FARTHER TO USE BETTER MAINTAINED ROADS

Option	District No.1	District No.2	District No.3	District No.4	District No.5	District No.6	District No.7	TOTAL	Percent
Better Maintained with Gravel	8	5	8	8	6	9	6	50	25.64
Better Maintained with Oil	6	2	4	4	3	2	0	21	10.77
Better Maintained Surfaced or Paved	18	17	15	18	22	18	16	124	63.59
TOTAL	32	24	27	30	31	29	22	195	100.00
Percent	16.41	12.31	13.85	15.38	15.90	14.87	11.28	100.00	

4. Selection of Farm Truck: The study participants were asked to indicate how they chose a farm truck to reflect the following:
   - road weight restrictions;
   - county elevator unloading facilities;
   - difficulty in loading from farm storage;
   - farm and farm driveway;
   - purchase price;
   - farm business operations;
   - other.

They were asked to check as many options as possible to reflect their situation. About 38 per cent of the responses related selection of farm trucks to farm business operations followed by purchase price. Over 18 per cent indicated concerns for road weight restrictions and nine per cent mentioned primary elevator unloading facilities. Table 89 responses regarding selection of farm trucks to reflect conditions listed above.

Reasons for Not Delivering Grain to the Closest Elevator

During the last several years producers have expressed concern about the lack of space at their local primary elevators and inadequate access roads to these facilities. Therefore, they were asked to reflect those concerns and point out the main reasons for not delivering grain to the closest primary elevator. The responses are presented in Table 90

About 30 per cent of the responses indicated that they could not deliver grain to the nearest or local primary elevator as it was often full. Twenty-seven per cent reported that they were getting a better price at a further elevator, therefore, they delivered grain there.

Less than 16 per cent said they shopped and did other business where they sold their grain. About 13 per cent indicated they had to wait in line at their local elevator therefore they deliver their grain to the farther elevator. Others indicated that the local elevator could not handle the size of their trucks (8.56 per cent) and that the road conditions were inadequate for their trucks (6.31 per cent).

Table 89

SELECTION OF FARM TRUCK UNDER DIFFERENT CONDITIONS

Conditions	District 1	District 2	District 3	District 4	District 5	District 6	District 7	TOTAL	Percent
Road Weight Restrictions	25	15	22	17	24	28	17	148	18.69
Primary Elevator Unloading Facilities	7	8	16	11	13	13	6	74	9.34
Loading From Farm Storage	2	3	2	3	1	3	2	16	2.02
Farm and Farm Driveway	8	3	3	6	5	5	5	35	4.42
Purchase Price	31	33	29	23	22	32	29	199	25.13
Farm Business Operation	44	47	46	37	44	47	34	299	37.75
Others	2	6	4	1	3	3	2	21	2.65
TOTAL	119	115	122	98	112	131	95	792	100
Percent	15.03	14.52	15.40	12.37	14.14	16.54	11.99	100	

Table 90

REASONS FOR NOT DELIVERING GRAIN TO THE CLOSEST ELEVATOR

Reasons	District 1	District 2	District 3	District 4	District 5	District 6	District 7	TOTAL	Percent
Road Conditions Inadequate	3	2	2	1	3	2	1	14	6.31
Shop and do Other Business Where I Sell my Grain	9	5	2	5	6	3	5	35	15.77
Local Elevator is Often Full	8	6	9	8	10	20	5	66	29.73
Have to Wait at Local Elevator	7	2	2	3	5	9	0	28	12.61
Local Elevator Cannot Handle by Truck Size	1	3	7	1	3	3	1	19	8.56
Get a Better Price at the Farther Elevator	9	11	3	4	14	13	6	60	27.03
TOTAL	37	29	25	22	41	50	18	222	100.00
Percent	16.67	13.06	11.26	9.91	18.47	22.52	8.11	100.00	

SECTION XIII

COMMENTS AND CONCERNS

The study participants were asked to express any concerns they had and provide any other general remarks. A summary of the comments or concerns is presented below.

The main and most often mentioned concern of farmers in all districts across the province was the high cost of producing their grain. Many farmers expressed their views particularly about increasing fuel, fertilizer and chemical costs while the prices they receive for their grain is decreasing or remaining constant. Some felt that the government should remove the tax on farm fuels.

Another main concern of farmers was the existence of road bans and the general condition of the roads. With road bans imposed during spring breakup, farmers could not haul as much grain as they normally would. Even with road bans, farmers still complain about the poor condition of roads in their area.

The issue of centralization also brought comments from farmers. The majority of farmers were against centralization or the closure of elevators with low throughput in small towns. By closing down an elevator, several things might happen that were not in the farmers best interest. By hauling his grain further to the centralized elevator he uses up more of his precious time, especially during harvest. It also costs him more in way of fuel, hired labor and additional wear and tear on his truck. He may have to buy a new truck or hire a custom or commercial hauler to get his grain to the delivery point. All of these cost him more money. The increased volume of grain that would be handled by the centralized elevators may lead to long waiting lines which would further increase the farmers' costs.

Although the majority of farmers strongly opposed the concept of centralization of elevators, some farmers wanted to see more centralization. One reason given was that by phasing out smaller centres, the railway company would not have to stop cars at every little point, thus trains would make fewer stop and still haul the same number of cars thereby getting the grain to export terminals faster. This means that the turnaround time for a grain car would be decreased, making more cars available to keep the centralized elevators from getting too full during the busy season.

An area that is closely related to centralization is the ability to maintain adequate unloading facilities. Many farmers noted that their closest country elevator's scales and pits were not capable of handling tandems or tractor-trailer units. Since farmers with large trucks must haul to further elevators with proper facilities, the amount of throughput the elevator maintains is lower than normal, thereby making the elevator costly and inefficient.

Another issue that was brought to our attention by farmers is the Crow rate issue. Some farmers want the government subsidy paid directly to them instead of being paid to the railways. Others mentioned that the increase in the Crow rate would result in a noticeable loss in farm revenues.